Liberating Potential? The Economic Effects of Finnish Crofter Liberation of 1918

Teppo Lindfors
Master's Thesis
University of Helsinki
Faculty of Social Sciences
Economics
May 2020

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

Tiedekunta/Osasto Fakultet/Sektion – Faculty Faculty of Social Sciences		Laitos/Institution– Department Department of Political and Economic Studies
Tekijä/Författare – Author Teppo Olavi Lindfors		
Työn nimi / Arbetets titel – Title Liberating Potential? The Economic Effects of Finnish Crofter Liberation of 1918		
Oppiaine /Läroämne – Subject Economics		
Työn laji/Arbetets art – Level Master's Thesis	Aika/Datum – Month and year May 2020	Sivumäärä/ Sidoantal – Number of pages 59

Tiivistelmä/Referat – Abstract

As of the 1980s, global poverty has witnessed a serious reduction. In numerous occasions, the reduction in poverty has been connected to an agrarian reform. A land reform is a type of agrarian reform which involves redistribution of land or changes in the legal framework for land administration. A large body of empirical studies have found that land reforms have proven to be a prominent tool in alleviating poverty.

In this thesis, I examine the economic outcomes of the Finnish land reform of 1918. The reform enabled tenant farmers, which covered around half of the rural population, to buy their farms with a fraction of the market price. As my identification strategy, I use instrumental variables analysis, exploiting arguably exogenous variation in the regional distribution of tenants. I employ municipal level data from decennial agricultural censuses from 1910 to 1941.

I find that the land reform increased capital intensity by around 23% in the two subsequent decades, which correspond to over third of the overall increase. Using a plain stochastic output model, I evaluate that this would signify a 14% increase in output at the farm level. Furthermore, I compute that the reform accelerated the structural transformation of agriculture toward dairy farming by 10 years. These effects are robust to controlling various municipal characteristics, such as natural conditions, population density and wealth. To confirm that the analysis does not simply capture dissimilarities in pre-reform development, I report baseline differences in municipal characteristics by regressing outcomes on the proportion of tenants with a cross-section for 1910.

These findings question the traditional view that the Finnish land reform regressed progress in agriculture. They are in line with the evidence on economic benefits of land reforms. As a novel contribution, this thesis is able to show that the effects are persistent. The exact mechanism driving the results could not be distinguished. I suspect, that the causal channel operated either through the farmers' improved incentives or an access to collateralizable assets, both dependent on property rights.

Avainsanat – Nyckelord – Keywords
land reform, crofter liberation, instrumental variables, property rights

Contents

1 Introduction

During the past fourty years or so, the world has experienced a massive success in terms of reducing absolute poverty on a global scale. In developing countries, the proportion of people living with less than \$2 per day shrank from 64.7% to 39.4% in 1990–2010 (Alvaredo and Gasparini 2013). In China, the proportion decreased from 88.1% to 46.7% in 1980–2001, while in India the corresponding numbers are 89.6% and 79.9% within the same time lapse (Schön 2015, p. 32).

In numerous occasions, the reduction in poverty has been connected to an agrarian reform. This is no surprise, taking account that around 75% of the world's poor live in rural areas (Binswanger-Mkhize, Bourguignon, and Brink 2009). As a prominent example, the tremendous increase in China's median income was predated by the decollectivization of farms in the late 1970s. India carried out a series of agrarian reforms after decolonialization in 1947, and the period from the 1960s to the 1980s is illustratively titled as the India's Green Revolution due to the massive increase in yields. Empirically, economic growth in agricultural sector has been estimated to reduce poverty more efficiently compared to other sectors (Christiaensen and Martin 2018). Finally, an increase in agricultural productivity has in historical perspective often preceded the process of industrialization. According to Gollin, Parente, and Rogerson (2002), improving agricultural productivity relieves resources (labour) for industrial activity, which is a potential precondition for kickstarting structural change. In England, agricultural productivity increased rapidly in 1600–1750, which drove down its employment share from 74% in 1500 to 35% in 1800 (Allen 2009, p. 17).

Clearly, succesful agricultural policy holds a great promise considering the material wellbeing of the world's poor. *Land reform* is a type of agrarian reform affecting land ownership. In practice, it may involve land redistribution or changes in the legal framework for land administration, exemplified by the already mentioned decollectivization in China. Land reforms have been rather prevalent in developing countries around the break of millennia, being carried out e.g. in Brazil, Guatemala, India, Malawi, Namibia, the Philippines, South Africa and Zimbabwe. The explicit goal of land reforms is typically poverty reduction, by providing the rural poor the most common asset of an agrarian economy, land. This relieves the peasants from the burden of a ground-rent and ideally creates incentives to improve production efficiency via securing private ownership (Binswanger-Mkhize, Bourguignon, and Brink 2009).

In my thesis, I will study the economic outcomes of the Finnish land reform of 1918. At the time, Finland was a comparatively poor agrarian economy with an agricultural employment share of around 70% (Ojala and Nummela 2007). Within agricultural employment, around 50% of people were independent landowners, while the rest were leaseholders (*vuokraviljelijä*. Ahvenainen, Pihkala, and Rasila 1982, p. 144). According to Haapala and Peltola (2018), the split of peasants into two hierarchic groups – the landowners and the landless – was the most significant social grievance of the Finnish society in the early 20th century.

However, by the late 1950s, the share of leaseholders had decreased to mere 1.5%.[1] The radical change was due to the so called Crofter Liberation of 1918, a law which allowed crofters (*torppari*) and cottagers (*mäkitupalainen*) to reclaim their farms with inexpensive prices (Peltonen 1988). By 1925, around 80,000 leaseholders had redeemed their farms, corresponding to approximately 10% of the total arable area in Finland (Ahvenainen, Pihkala, and Rasila 1982, p. 192). I argue, that this massive redistribution of assets serves an interesting opportunity to examine the causal connection between property rights and investment. My research question is the following

- What was the long-term effect of the Finnish land reform of 1918 on agricultural investment and production structure?

As my identification strategy, I use instrumental variables analysis (IV), exploiting arguably exogenous variation in the regional distribution of the crofter system. I construct a *Bartik* instrument which measures intensity of the land reform at the municipal level. To confirm that the analysis does not simply capture dissimilarities in pre-reform development, I report baseline differences in municipal characteristics by regressing outcomes on the proportion of tenants with a cross-section for 1910.

[1] Official Statistics III, The 1959 Census of Agriculture, p. 22.

As my principal data source, I use municipal level data from decennial agricultural censuses from 1910 to 1941.

I find that the land reform increased capital intensity by around 23% in the two subsequent decades, which corresponds to over third of the overall increase. Using a plain stochastic output model, I evaluate that this would signify a 14% increase in output at the farm level. Furthermore, I compute that the reform accelerated the structural transformation of agriculture toward dairy farming by 10 years. These effects are robust to controlling various municipal characteristics, such as natural conditions, population density and wealth.

The thesis is structured as follows. In the following section, I provide a brief history of the Finnish crofter system and the policies that abolished sharecropping in Finland after 1918. In Section 3, I review theoretical and empirical literature on land reforms in general, and on the Finnish case in particular. Sections 4 and 5 describe the applied methodology and data. In section 6, I report the results and discuss their causal interpretation and meaning. Section 7 concludes.

2 The Finnish Crofter System

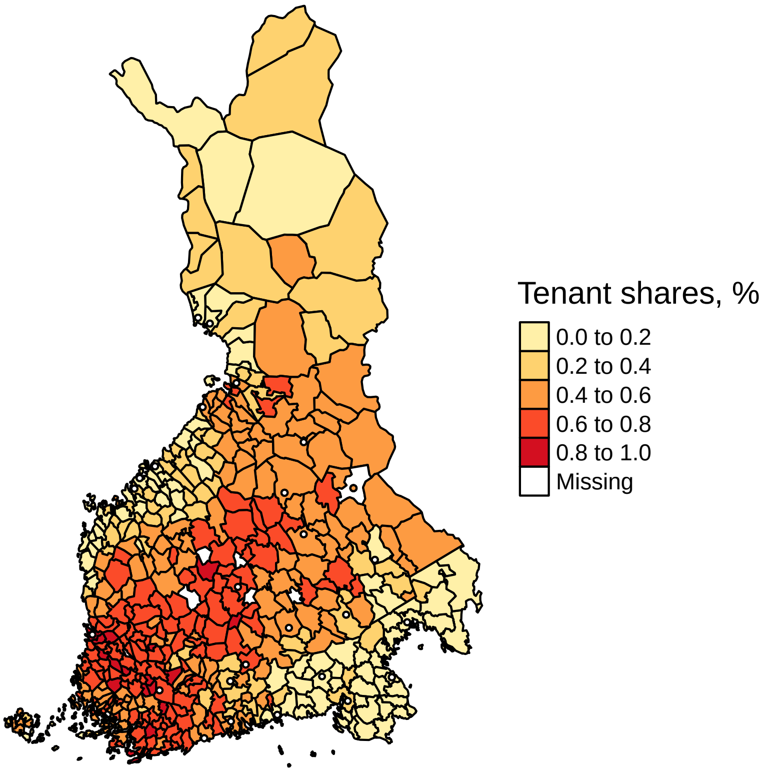
The crofter system, also known as ”widescale subfarm system” emerged in Finland during the 17th century as a solution to the growing labour demand of manors. The crofters were small leaseholders, who paid their rent mainly in labour.[2] Manors had a privilege to set up crofts until the mid-18th century, when the entitlement was further extended to all independent landowners. Because of the head start, the provinces with the most manors, namely Turku and Pori and Häme, remained the principal tenant regions as long as the system prevailed (Ahvenainen, Pihkala, and Rasila 1982, p. 145). Nonetheless, rapid population growth rate along with constraints on land division created a strong incentive for all landowners to establish crofts, which made the extension of the entitlement inevitable. Rasila (2003) argues that the prevalence of tenants was an outcome of two mechanisms. Firstly, there was the regional distribution of manors. Secondly, crofts answered to the increasing land demand of landowners' offspring and the landless population. As the Finnish population grew over 3-fold during the 19th century (Vattula 1983, p. 17), the demand and thus the number of new crofts increased also with a notable pace. Peltonen (1988) calculates that around 40% of all landowners had atleast one tenant at the eve of WWI. The proportion of tenants by municipality in 1910 is displayed in Figure 1.

While the expanding population drew up the number of crofters, it also put pressure on the subpopulation's social status by increasing the labour supply (Soininen 1974, p. 39). The social grievance grew more and more apparent in the countryside in the late 19th century. When the stock of available arable land began to grow thin, *cottagers* replaced crofters as the most quickly expanding tenant farmer type. Cottagers were just like crofters in every other respect, but did not earn most of their living by farming their own land. In formal terms, cottagers were leaserholdes who owned less than 2 hectares of own land.

On top of changing interclass tensions in the late 19th century, Finnish agriculture also became under severe external pressure around the same period. The extension of railway network and the spread of steam vessels integrated global commodity

[2] Peltonen (1988).

Figure 1: Geography of Tenancy: Tenants in 1910 as a Share of All Farms



Sources: Agricultural census 1910. The map was kindly provided by Matti Mitrunen.

markets in an unforeseen manner, putting downward pressure on the price of grain (O'Rourke and Williamson 1999). While most of Europe responded to the so called grain invasion by raising grain tariffs, Finland was among the few countries that held on to duty-free import of grain in the latter half of the 19$^{\text{th}}$ century (Niemelä 2008, p. 119). As the trade shock was not curbed by policy, Finnish peasants adapted by specializing in dairy farming.[3] Indeed, from 1861 to 1913, the proportion of dairy farming of gross production in agriculture increased from 45% to 69% (Figure 2).

As a blessing in disguise, the stuctural shock that the grain invasion inflicted intensified the mechanization of Finnish agriculture. From a broader perspective, the

[3] The shift to dairy farming was almost universal reaction to the grain invasion in Northwestern Europe (O'Rourke and Williamson 1999). Considering the Finnish response, see Peltonen (2019) or Peltonen (1988).

Figure 2: Dairy Farming, % of Gross Production in Agriculture

Sources: Viita (1965).

role of machinery was rather insignificant in European agriculture before WWI (Van Zanden 1991). From the medieval times, productivity leaps were based on new cropping techniques, breeding or on the slow application of chemical fertilizers. This was about to change in the interwar period, when immensely labour-saving machines, chiefly reapers, treshers and rakes began to popularize. Finland was no exception in this respect. Structural transformation toward dairy farming relied on bulk production of feed, and the application of machinery was most beneficial in the cultivation of fodder crops (Peltonen 1992, p. 109; Niemelä 2008, p. 150). Thus, Finland's growing interest towards dairy production was complemented by the mechanization of cultivation. In 1910, almost two thirds of the area under cultivation was already allocated to fodder crops (Niemelä 2008, p. 144).

While specializing in dairy farming improved agriculture's efficiency, it was not without distributional consequences. The structural transformation of agriculture aggravated the rental terms of tenants. Seizing the opportunity, the landowners pursued to shift the costs of degrading competitiveness and structural changes to the sharecroppers. In practise, this meant increasing rents, but occasionally also evictions. As the lands of the evicted peasants were typically turned into pasture or grasslands, link between evictions and the structural transformation was evident (Peltonen 2004). In addition to the structural pressure within agriculture, the kick-start of Finnish industrialization and development of lumber industry in particular inflated the price of timber, which put crofters at a disadvantage with respect to the forest-owning freeholders. The income from timber was often crucial in financing agricultural investment (Alapuro 2018, p. 41).

For the aforementioned reasons, the social standing of crofters was on a downstream at the break of the 20$^{\text{th}}$ century. The average income of a crofter was around 50% to 85% of a freeholder with equal amount of land. Since crofters had smaller farms than freeholders to begin with, saving for investment was hard. According to Niemelä (2008) the most common piece of agricultural machinery, the reaper, was too expensive for small farms, yet alone for crofts. Moreover, Peltonen (2004) argues that financing investment by bank loans was downright impossible for crofters, because they lacked collaterals. If one could afford to invest, in either land or capital, he had to still weigh up the risk of eviction. Finally, "extra days" which could be required from leaseholders in addition to the agreed ground rent exacerbated the uncertainty of tenancy. Although the extra work was paid for, it hindered the execution of the tenants' own harvest (Peltonen 1988).

The tenants' grievance eventually lead to reactions in several fronts. In the 1900s, strikes and the evictions of crofters became more common.[4] The insufficient compensation of evicted peasants for past investment, such as the preparation of soil, was a constant issue. Statutory improvements in the tenants' position began to look inescapable in the eyes' of the elite in order to avoid a full rebellion. Consequently, tenancy laws were revised in 1902 to clarify the compensation of evicted tenants' investment. Effectively, the revision kept status quo unchanged, since com-

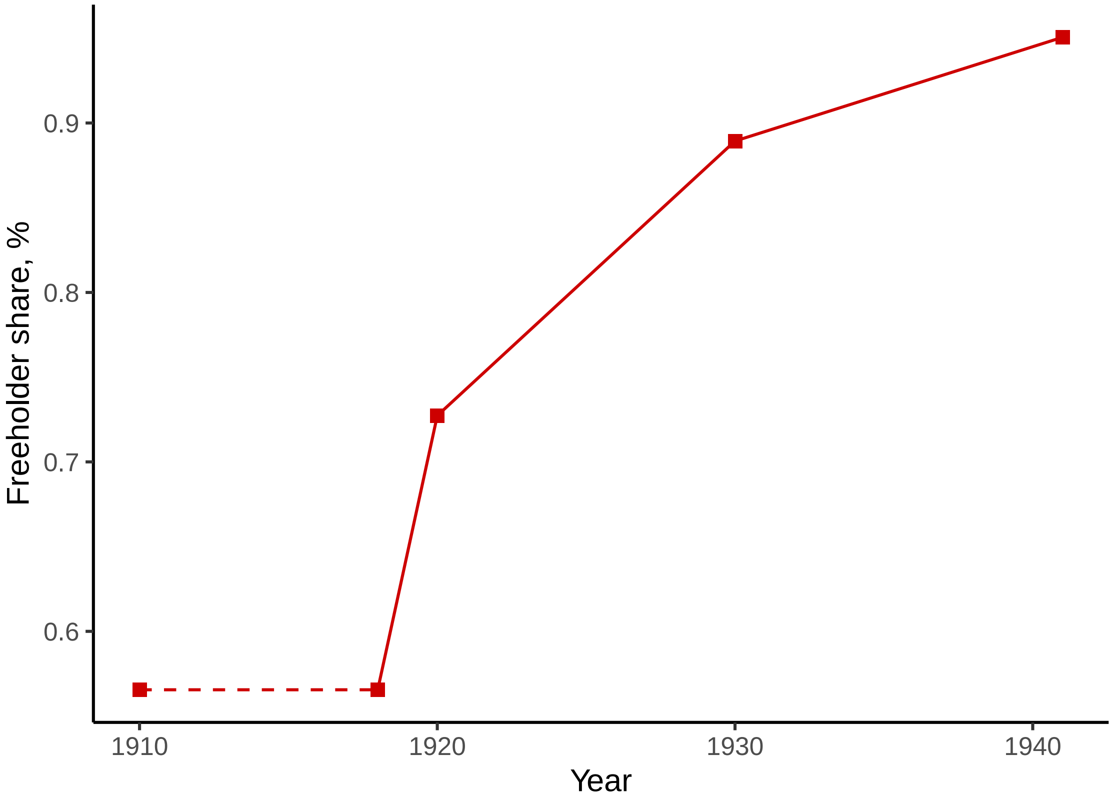
[4]In 1902–1909, 2000-2500 crofters had to leave their crofts. See Peltonen (2004).

pensation was determined conditional and thus was easily avoidable (Peltonen 1992, p. 287). In the Leaseholding Act of 1909 the tenancy laws were revised again in a way that turned out crucial for triggering the countryside's growing antagonism. The act ordained the compensation of tenants' investment mandatory and extended the minimum length of new leases up to 50 years. The extension was prescribed effective of 1916. The immediate outcome was, that keeping tenants became generally far more binding and unprofitable. Consequently, evictions soared. In the province of Häme, almost 30% of all tenants were evicted from 1909 to 1914 (Rasila 1970, p. 26; Peltonen 2004).

The crofter question was set aside as Finland started a bitter Civil War in early 1918, shortly after the declaration of independence in December 1917. Only two months after the conflict the incumbent parliament enacted a land reform which allowed all tenant farmers to buy their farms at the price level of 1914, effective of 1919. The reform, also known as the Crofter Liberation, was passed to solve the crofter issue once and for all. Despite the suggestive succession of events, the leaseholding problem's role in inflicting the war is unclear.[5] Even so, the land reform was partly motivated by the leading parties' will to curb the tenants' sympathy towards social democracy (Jäntti, Saari, and Vartiainen 2006). The law was widely utilized and it virtually ended tenant farming in Finland by the late 1940s, evident in Figure 3. In a typical titling process, the state paid the land's redemption price and the tenant became a debtor to the state, while the debt's term to maturity was 38 years. Because the nominal price of land was set according to the price level in 1914 but the debt was paid in the 1950s, the real price of land ended up often extremely low (Vihola 2003). In 1922, the right to acquire land was further extended to all agricultural workers through a law known as *Lex Kallio*, nicknamed after the contemporary prime minister. Lex Kallio also allowed the already emancipated farms to expand their grounds. In priciple, the land sales in 1918–1922 were enforced by expropriation, but in practice it was seldom necessary.

[5]The traditional view is, that the crofter question was not a decisive factor in iniating the civil conflict (Rasila 1969). However, this position is challenged by recent research: see Mitrunen, Virkola, and Meriläinen (2019).

Figure 3: Freeholders as a Share of All Farms 1910–1941



Notes: The dashed line remarks that the freeholder share is assumed to be constant in 1910–1918.
Sources: Agricultural censuses 1910–1941.

3 Literature Review

This section provides a brief introduction of previous theoretical and empirical research on land reforms. I start by describing the most common theoretical insights on the mechanisms affected by the reforms. With the benefit of hindsight, I focus on property rights in particular and present a basic model which encaptures their interrelation with agricultural outcomes. Next, I move on to empirical research, reviewing studies on the Finnish land reform and reforms in general while prioritizing comparability with the Finnish setting. Finally, I attempt to summarize the literature to distinguish the majority view.

3.1 Theory

On theoretical light, the effect of a land reform on agricultural production is ambiguous. For one, since leaseholder farms are typically ex ante smaller than freeholder farms, a reform pushes the farm size distribution toward zero. In case agricultural production enjoys increasing returns to scale, the reform's effect on productivity and investment will be negative (Binswanger-Mkhize, Bourguignon, and Brink 2009). Especially if the production inputs are lumpy, gaining efficiency through increasing inputs (like expensive machinery) may call for large scale. Scale advantage is easy to imagine when one compares e.g. threshing grain by hand to threshing by a modern combine harvester. The latter technique is immensely labour-saving, and becomes even more beneficial the bigger the field. However, other agricultural technologies such as fertilizers do not necessarily behold scale advantage. Moreover, empirically the correlation between farm size and agricultural productivity is often found *negative* both within and across developing countries (Adamopoulos and Restuccia 2019). That said, in developed countries the farm size has shown an unequivocal tendency to grow over time (Eastwood, Lipton, and Newell 2010).

Ignoring economies of scale, decreasing farm size may also boost agricultural productivity or investment by cutting monitoring and search costs (Ravallion 2016). In smaller farms monitoring employees is easier simply because the distances are shorter. In addition, as smaller farms often imply more family farms, monitoring family members could also prove more efficient. Family farming obviously decreases the search costs of a farm, when family members make up the labour force.

Aside from theoretical implications of changes in farm size, perhaps the most important theoretical consideration on land reforms is the revision of property rights. In a textbook scenario, some proportion of the landless population is granted with land either for free or for a fee, which extends private ownership for the novel landowners. As the ex-landless now own the land they maybe used to rent or work on, their incentives for investment and efficient production ought to have improved (Besley and Ghatak 2010). The intuitive appeal of the incentive mechanism comes clear if one takes the position of a sharecropper: investing in machinery, livestock or especially on land is futile, if the lease is abruptly terminated. Thus, the sharecropper's investment is limited by uncertainty related to the tenancy. Similarly, an agricultural day labourer or a sharecropper who is paying his rent as labour has an incentive to shirk since he is not the residual claimant.

While a land reform often extends private ownership for some, it also violates the property rights of others. If the land reform incorporates expropration of land from the old private landowners, it may discourage them from investing in the future (Goldstein and Udry 2008). The underlying reason is the same as with the sharecroppers, namely contract uncertainty, but this time around the contract considers property rights rather than tenancy.

Based on the upcoming analysis and qualitative evidence of the Finnish crofter system, I argue that improvement in the security of the tenants' property rights was a key component changing due to the Finnish land reform. To structure this idea, I present a simple model of the interconnection between property rights and farmers' incentives. The model was originally developed by Besley and Ghatak (2010).

The Model

Consider a single producer economy, where the farmer chooses effort $e \in [0, 1]$ of which he has an endowment $\bar{e} \leq 1$. The effort can symbolize various things, such as inputs of labour, land or capital. Output is stochastic, and committing effort produces output A with probability $\sqrt{e}$ and zero with probability $1 - \sqrt{e}$. Expected output is then

$$\mathbb{E}(y) = \mathbb{E}(A\sqrt{e} + 0 \cdot [1 - \sqrt{e}]) = A\sqrt{e} \tag{1}$$

The farmer's utility is simply a sum of consumption and leisure, i.e.

$$u = c + l$$

Now, suppose that the output is expropriated with probability $\tau \in [0, 1]$. Consequently, the farmer's expected consumption can be written as

$$\mathbb{E}(c) = \mathbb{E}(A\sqrt{e}(1 - \tau) + 0 \cdot \tau) = (1 - \tau)A\sqrt{e}$$

As committing effort creates disutility, the farmer's optimization problem is

$$\max_{e} \ (1 - \tau)A\sqrt{e} + \bar{e} - e \quad \text{s.t.} \quad e \leq \bar{e}$$

The first-order condition for an interior solution is

$$\frac{(1 - \tau)A}{2\sqrt{e}} = 1$$

From which we can solve the optimal choice of effort e^*

$$e^* = \left(\frac{(1 - \tau)A}{2}\right)^2 \tag{2}$$

Equation (2) captures an essential insight: the farmer's effort is decreasing in τ, i.e. it is decreasing with the risk of expropriation. This incentive effect emerges because the farmer is *uncertain* whether he can enjoy the fruits of his work while he chooses how much effort to commit. As such, the model predicts that the Finnish land reform ought to have increased effort by eliminating the risk of expropriation from the ex-tenants. In this study, I proxy effort by agricultural investment and production structure. The tenants' investment could be literally expropriated if the tenant was evicted, since investment on land went often uncompensated. Capital investment could not be expropriated but became redundant in case of an eviction, and reselling the equipment was costly. Production structure reflects effort insofar as it captures how the farm is managed.

3.2 Empirical Evidence

There is no previous econometric evidence considering the Finnish land reform of 1918 to my knowledge. Sarvimäki (2011) studies a Finnish land reform of 1945, where the primary goal was to resettle evacuated population from the region conquered by Soviet Union over WWII. He finds that municipalities more exposed to the reform modernized faster in terms of production structure and experienced faster wage growth in the upcoming decades. The setting in Sarvimäki (2011) is, however, not directly comparable to the 1918 reform, since it was mainly about resettlement rather than property rights.

Evidence from Finland

The conventional wisdom among previous research on the Finnish land reform is that it retarded economic development in agriculture by reducing specialization and curbing economies of scale. Indeed, agricultural sector showed some conservative progression during the interwar period. A shift toward small-scale farming combined with protectionist trade policy resulted in a more autarkic production at the farm level (Soininen 1985). The regression is apparent in Figure 2, which shows that the gross output share of dairy farming decreased from 69% to 61% between the wars. Self-sufficient grain growing gained ground at the expense of commercialized dairy production. Autarkic food production was actually an explicit goal of economic policy, responding to the severe shortages which tested the Finns at the end of WWI. During the Bolshevik Revolution in 1917 grain imports from Russia dwindled to nothing. Consequently, variety became a guiding principle of agricultural production in order to strenghten the security of supply. The new ideal was pursued by subsidies and tariffs, and the land reform was seen as another opportune intervention. Accordingly, Heikkinen (2017) and Hjerppe (1988, pp. 67–71) judge that the land reform slowed down the commercialization of agriculture and the structural transformation of Finnish economy in general by stimulating autarkic small-scale farming. Further, Soininen (1985) suggests, that the spread of smallholdings curtailed the acquisition of agricultural machinery. In international comparison, agricultural productivity was weak, reaching only 50–74% of the European average in 1931–1935 (Ahvenainen, Pihkala, and Rasila 1982, p. 206).

On the other hand, there are reasons to think that the land reform actually had a positive effect on agricultural production which has escaped the attention of previous research. First, pioneer farming geared up, leading to an increase in the area under cultivation of almost 25% (Ojala and Nummela 2007). Vihola (2003) argues that the improved security in the status of ex-tenants encouraged to open fields. Second, despite pioneer farming effectively meant starting the cultivation of inferior soil, land productivity with respect to milk and grain increased in 1920–1940. Labour productivity followed a similar pattern (Ojala and Nummela 2007). Third, while the land reform potentially improved the incentives of ex-tenants, it also could have encouraged agricultural investment of the former landlords. Ahvenainen, Pihkala, and Rasila (1982, p. 209) suggest that the landlords compensated the lost ground rents by capital investment, which would imply that the reform had even greater significance in terms of investment behaviour. Fourth, after Lex Kallio in 1922 enabled the ex-tenants to expand the farms they had bought, the effect of land reforms on farm size distribution remained ultimately negligible (Vihola 2003).

Land Reforms Elsewhere

As mentioned in the introduction, land reforms have become quite prevalent tool of development policy in the developing countries in the 21st century. Luckily, they have also been studied extensively. The historical and geographical context of the land reforms in current day Asia or Africa is evidently a lot different compared to the one in Finland in the interwar period. However, it is important to note that the level of GDP per capita in Finland by the time of the land reform was only around 1800 2011 US$, which would rank it at the bottom 12th percentile of cross-country income distribution in 2016, implying that the economic situation in Finland was roughly comparable to the developing world today.[6] In the following review, I will describe

[6] Calculation is based on data from the Maddison Project Database.

the recent empirical literature on land reforms around the world and over time and pursue to present it in order of importance, stressing institutional resemblance with the Finnish reform. Most of the following articles have explicitly aspired to estimate the causal effect of the reform, and I intend to explain how.

Recent studies suggest, that increasing the output shares of farmers can produce substantial improvement in their standard of living. Keswell and Carter (2014) study South Africa's Land Redistribution for Agricultural Development program, in which the state offered land purchase grants to landless farm workers and labour tenants. Conceptually, the purchase grants are analogous to the state loans granted over the Finnish land reform, since in Finland inflation shifted the bulk of the loan's incidence to the wealthy landowners. To identify the program's causal effect on consumption per capita, Keswell and Carter exploit random lag in the timing of the land transfer which was due to the bureaucracy of the approval process. They find that in 3 to 4 years, the treatment group's per-capita consumption increases by 50% in contrast to the control group. From institutional perspective, the reform was quite radical as the status of the treated upgrades from a landless worker to a landowner overnight, which may explain the program effect's staggering magnitude. Burchardi et al. (2018) examine a similarly fundamental incentive revision in Uganda. Burchardi et al. run a randomized controlled trial (RCT), where they propose different output-sharing rules for female farmers in a random manner. They discover that when a farmer agrees to keep 75% instead of 50% of her output, she increases her production by 60%. In addition, the acquisition of agricultural tools goes up by 29%. In the early 20$^{\text{th}}$ century Finland, the tenants' average rental stress was approximately 30–40% of net production. Consequently, once the tenant became a freeholder, his output share increased by around 40 to 70 percent, which comes qualitatively close to the proportional increase of an Ugandan farmer in Burchardi et al.'s RCT.

There are also valuable inquiries on the more minor incentive adjustments. In a seminal paper, Banerjee, Gertler, and Ghatak (2002) use differences-in-differences to study a tenancy reform program of 1970s in West Bengal. The program introduced several improvements in the tenants' status, including permanent tenure contracts and de facto higher output shares.[7] Consequently, rise yields per hectare increased

[7]There was no statutory increase in the output shares, but they grew as tenants gained bar-

on average by 5% in West Bengal compared to control districts in Bangladesh. As another example, Goldstein, Houngbedji, et al. (2018) look at an RCT in Benin, where randomly picked villages go through a demarcation process. The idea is that demarcation enhances security of private ownership by making land rights indisputable. In comparison, titling over the Finnish reform strengthened security by abolishing the threat of an eviction. Indeed, Goldstein et al. establish that the treated villages increased their agricultural investment by 23% to 43%. However, the short term effect on output was close to zero.

In a few other papers on land reforms or related set-ups the institutional change is hard to evaluate. For example, Besley and Burgess (2000) focus on the cumulative number of state-level reforms in India in 1958–1992. This complicates the interpretation, because the reforms are not exactly summable. Still, after instrumenting the stock of reforms with lagged composition of the local parliament, Besley and Burgess report that the reforms caused a reduction in the poverty headcount ratio. Curiously, the reforms also had a negative association with agricultural yields.

Aside from studying the effect of actual reforms, Goldstein and Udry (2008) find that farmers with a higher position in local political hierarchy are more eager to invest and run more profitable farms in Ghana. To handle endogeneity, Goldstein and Udry argue that they are able to measure exogenous variation in farmers' political position, using variables which determine the individual's status within the village and matrilineage, such as parental education. Banerjee and Iyer (2005) demonstrate that a tradition of non-landlord system in colonial era lead to approximately 40% bigger yields in post-independence India. The authors use district-level panel data and their treatment variable is the area under landlord control within a given district. To deal with endogeneity, Banerjee and Iyer use an intriguing historical instrument, which indicates whether the district was conquered by the British in 1820–1856. Arguably, the British conquest in 1820 to 1856 increased the probability of a non-landlord system due to reasons unrelated to post-independece yields, making it a feasible instrument.

Considering articles with a closer historical and geographical proximity to inter-war Finland, Markevich and Zhuravskaya (2018) study the abolition of serfdom in

gaining power.

19th century Russia. Using province-level differences-in-differences plus instrumental variables as their identification strategy, Markevich et al. find that the emancipation increased the Russian GDP by astonishing 17.7%. Notable thing here is that while liberating serfs is starkly different from giving land to the tenants, in both cases the key element changing is incentives. In Russia, second serfdom reduced the landowners' incentives to make capital investments, both physical or human where the latter refers to the education of serfs. As for other neighboring countries, Olsson and Svensson (2010) show that freeholder farms produced more crops than tenants in Southern Sweden in 1700–1850. The authors suggest that the underlying reason were secure property rights, which promoted investment. However, since Olsson and Svensson (2010) cannot control for fixed farm characteristics as they lack panel data, the estimates could be biased by unobserved time-invariant farm-level factors.

Because of the heterogenous nature of land reforms, it is of foremost importance to know which mechanism is driving the post-reform outcomes. Relying on theoretical work and on the context-specific institutional details of each reform, the authors of empirical papers have proposed a variety of channels. Unfortunately, often distinguishing the particular causal mechanism is unfeasible, as identificiation relies on quasi-experimental design and the treatment is not controlled by the researcher. For example, while Keswell and Carter (2014) and Banerjee, Gertler, and Ghatak (2002) find that land reforms in South Africa and West Bengal lead to favorable economic outcomes, they are unable to separate whether this happens due to improved incentives or the redistribution of collateralizable assets. This caveat does not concern RCTs. Curiously, two different RCTs carried out in African countries highlight the significance of incentives. In Uganda, Burchardi et al. (2018) establish that strenghtening the incentives of farmers by increasing their output shares boost production and the procurement of tools. In Benin, Goldstein, Houngbedji, et al. (2018) argue that they can identify effect of improved security on investment *excluding* the influence of collaterals. Goldstein, Houngbedji et al. may focus specifically on security, since they can measure outcomes before the farmers received transferable certificates on their property. At this stage, the revision in security was based on the laying of cornerstones.

To summarize, land reforms appear to increase production and agricultural investment according to the majority of empirical research. That said, the evidence is not entirely uniform, and an efficiency-equity trade-off is apparent in a few occasions: while the reform might alleviate poverty, it can simultaneously reduce yields. Some studies seem to suggest that the peasants' incentives are an especially important mechanism affected by the reforms and in producing fortunate outcomes. In spite of theoretical interest,[8] the relative significance of collaterals has been rarely examined in empirical work on land reforms. Previous research on the economic consequences of the Finnish land reform in particular is scant. Still, qualitative evidence indicates that the reform curbed the commercialization and specialization of agriculture by encouraging a shift toward small-scale farming.

[8] See e.g. Federico (2008, p. 120) or Banerjee and Duflo (2005).

4 Methods

In this section, I will elaborate the selected identification strategy, namely instrumental variables analysis. Ultimately, my aim is to evaluate the causal effect of a national land reform on agricultural investment and production structure. At first glance the identification seems troublesome: there is no natural control group as the reform is national, not local. However, I argue that the pre-treatment proportion of tenants provides exogenous variation in the intensity of the reform at the municipal level.[9] The larger the proportion of tenants, the bigger the change in ownership, i.e. the greater the treatment intensity. I will construct a *Bartik* style instrument[10] of the following form

$$Bartik_{m,t} = T_{m,1910}\left(\frac{F_t - F_{1910}}{F_{1910}}\right) \tag{3}$$

where $T_{m,t}$ is the share of tenants in municipality m in 1910 and $\frac{F_t - F_{1910}}{F_{1910}}$ is the cumulative change in the share of freeholders at the national level. Thus, larger values of $Bartik_{m,t}$ signify greater change in proprietary rights. The analysis is based on reduced form regressions of the following form

$$y_{mt} = \alpha + \beta Bartik_{mt} + \phi_m + \mu_t + \mathbf{x}'_{mt}\boldsymbol{\gamma} + \epsilon_{mt} \tag{4}$$

where y_{it} is the outcome of interest, α is a common constant, ϕ_m is a municipality fixed effect, μ_t is a year fixed effect and $\mathbf{x}'_{mt}$ is a vector of controls. In essence, I am comparing the outcomes between municipalities with higher and lower pre-treatment share of tenants, conditional on covariates. The identifying assumption is that the pre-treatment share of tenants would have had no effect on the evolution outcomes absent the land reform (Goldsmith-Pinkham, Sorkin, and Swift 2018).

In an ideal experiment, I could randomly assign different municipalities to implement a land reform. Because the treated municipalities would be randomized, I could estimate the reform's causal effect by simply computing the difference in mean outcomes between the treatment and the control group.[11] The instrumental variables approach I am exploiting offers a second best option of the ideal experiment. To

[9] Credit for the identification strategy goes to Matti Sarvimäki.

[10] See Goldsmith-Pinkham, Sorkin, and Swift 2018.

[11] Given that the municipalities are similar enough to begin with.

realize this, first observe that the share of tenants determines the reform intensity. The only deviation from the ideal experiment is that the share is continuous, not binary. In the 2SLS framework, the first stage equation is

$$Bartik_{mt} = \pi + \delta Bartik_{mt} + \psi_m + \theta_t + \mathbf{x}'_{mt}\boldsymbol{\kappa} + \varepsilon_{mt} \tag{5}$$

which is redundant because the first stage fitted values simplify to

$$Bar\hat{t}ik_{mt} = Bartik_{mt}$$

In another words, the Bartik instrument serves also as the treatment variable. As a corollary, the reduced form equation (4) is equivalent with the second-stage equation.[12]

Second and more importantly, I claim that the share of tenants is conditionally random across municipalities. This assumption works as an imperfect replica of randomization in the ideal experiment. In the terminology of instrumental variables, it is known as the *independence assumption*. In the context at hand, the share of tenants should be unrelated to any other determinants of agricultural investment or production structure, conditional on controls.[13] By including municipality fixed effects, I am absorbing constant differences in the outcomes between municipalities, such as differing specialization due to fixed natural conditions. Year fixed effects eliminate the impact of common time effects, like the general mechanization of agriculture common to all municipalities. Thus, what is left to be controlled for are omitted variables which are not constant for neither across municipalities nor over time. Following the existing literature utilizing comparable identification strategies (Autor, Dorn, and Hanson 2013; Markevich and Zhuravskaya 2018; Mitrunen 2019), I add control variables of various pre-treatment characteristics interacted with a post-reform dummy to allow their effect change over time.

In chapter 2, I spelled out that there is mainly two sources of variation in the cross-municipal share of tenants. First is the location of manors, as the lords of

[12]See Wooldridge (2010, pp. 89–90).

[13]In addition to the independence assumption, causal interpretation of an IV estimate requires fullfilment of the so called exclusion restriction (Imbens and Wooldridge 2009). For a reduced form estimate, conditional independence is sufficient. See Angrist and Pischke (2009, Chapter 4.4).

the manors had the privilege to let crofts from the early 17$^{\text{th}}$ century to the mid-18$^{\text{th}}$ century. Therefore the municipalities which had manors at the time got a head start in the crofting system, resulting to a potentially higher tenant share in the early nineteen-hundreds. Second is the population density in around 1750 to 1917. While land division was illegal until the latter half of the 19$^{\text{th}}$ century, population pressure was managed at the municipal level by renting crofts. Increase in the number of potential tenants, chiefly the offspring of landowners or the landless peasants, boosted the demand for crofts and consequently the crofter system became particularly widespread in the densely populated areas of Finland.

Manors were large estates, on average significantly wealthier than the freeholders. Freeholders, on the other hand, were on average wealthier than the tenants. Because of the varying composition of manors, freeholders and tenant farmers, the ability to afford agricultural investment and economies of scale varied at the municipal level. For example, Niemelä (2008) argues that in 1910, the most common piece of agricultural machinery, the reaper, was too expensive for small farms. Furthermore, Peltonen (1992) shows that the tenant farmers were more poorly equipped in the more expensive machinery, such as the treshers, in the municipalities of Tammela and Urjala in 1912. Clearly, the average wealth of farms could affect the capital-intensity or production structure by municipality, and is directly influenced by the proportion of tenants. To assure that wealth differences are not driving my results, I control for the interaction between pre-reform farm size and a post-reform dummy, $farmsize_{m,1910} \times post_t$.

Higher population density increases the interaction of people in a given area. The more there is interaction, the faster the information spreads. Therefore, it is plausible that population density is positively correlated with the mechanization or specialization of agriculture at the municipal level. Peltonen (1992) elaborates this argument by stating that the scattered distribution of farms held up the diffusion of innovations outside Southwestern Finland. I control for the likely differences in the diffusion of knowledge by adding an interaction term between pre-reform population density and a post-reform dummy, $density_{m,1910} \times post_t$.

Indirect links between the regional distribution of manors and population density are no less calamitous to the validity of my identification strategy. To start with, consider that the location of manors is probably a function of the residential preferences of the lords. The lords most likely wanted to settle in areas where upholding of a large estate was the most profitable, which would require nutrient-rich soil. If the soil quality in manor municipalities is superior to other municipalities, it could affect the trend of agricultural investment in the treatment group by altering the demand of machinery and land. Moreover, soil quality obviously determines the comparative advantage and thus the optimal production structure of each municipality. According to Peltonen (1992), climate-based comparative advantage in agriculture caused Southwestern Finland to be clearly more capital-intensive in the 1910s in comparison to other regions. To account for this indirect link with my instrument and the outcomes, I control for the timevariant effect of nutrient-rich clay soil and arid sand soil by adding interactions $clay_m \times post_t$ and $sand_m \times post_t$. Both soil variables measure the fraction of field under the respective soil type at the municipal level.

In addition to the quality of the soil, weather is an important part of the natural conditions that determine the comparative advantage of agriculture. On one hand, favorable climate improves the comparative advantage of agriculture in a given region with respect to industry or services, which probably increases the amount of resources devoted to the production. On the other hand, as Federico (2008) points out, unfavorable weather conditions increase the demand of compensatory agricultural machinery. In sum, while weather probably influences agriculture's regional specialization, it could affect investment either way, and is probably another argument of the lords' residential preferences. Acknowledging this, I control for region-specific temperature and rainfall, $temp_{rt}$ and $rain_{rt}$.

Lastly, if some agriculturally-relevant public policy affects the municipalities differently according to the share of tenants, the exogeneity condition will be violated. To my knowledge, the only relevant policies at the time were heavy tariffs and export subsidies, insofar as they were biased toward certain products. According to Ahvenainen, Pihkala, and Rasila (1982), a noteworthy change was an increase in the price ratio of grain and dairy products in the 1930s. Since one of the outcome variables of interest is the structural composition of farming, however, the price break can be reckoned with.

To summarize, I argue that the share of tenants is independent of potential outcomes conditional on municipality and time fixed effects, pre-reform wealth, population density, soil quality and region-specific temperature and rainfall. This is a strong assumption and critical for the causal interpretation of β. In the above, I have tried to validate its credibility. One way to bolster the plausibility of the assumption is to check whether the municipalities with higher pre-treatment share of tenants were on a divergent trajectory from the municipalities with lower pre-treatment share of tenants before the reform in terms of outcomes. Following the example of Hornbeck and Naidu (2014) and Mitrunen (2019), I intend to conduct this precaution using a cross-section for 1910.[14]

[14] A general discussion of testing for balance with instrumental variables can be found in Angrist and Pischke (2015, Chapter 3).

5 Data

As my principal data source, I am using publicly available municipal level data from decennial agricultural censuses from 1910, 1920, 1930 and 1941.[15] The censuses include information on the number of freeholders, tenants, agricultural machinery, farmed animals, arable area and soil quality, covering for the majority of dependent and explanatory variables. The census data was collected by National Board of Agriculture using door-to-door interviews covering the whole population. As interviewers, the board hired people with ”agricultural know-how”, who often turned out to be other peasants.

Combining data from the censuses and several other sources, I construct an unbalanced panel dataset from 1910 to 1941, using a municipality as the unit of observation. Putting up the data was not straightforward, since the municipal structure in Finland underwent a radical change over the time frame. Specifically, municipal separations and the loss of territories to the Soviet Union in 1940 pose notable measurement problems. To address the separations, I have used municipal structure in 1910 as the basis, and aggregated any separated municipalities using a novel municipal crosswalk from 1910 to 1941. In case the separated units deviated significantly from the 1910 borders, I have excluded them from the sample altogether.[16] To ensure that territorial changes of any sort are not mixing up the results, I control for the area of each municipality as a sensitivity check.

Relative to the whole agricultural population, the censuses' cross-sectional and periodical coverage is quite impressive. As a general rule, the censuses include all peasants who owned either any land or atleast one farmed animal.[17] That said, there were some alterations on the minimum farm size included to the sample each decade. In 1910 and 1920, the census excluded farms which had less than 0.5 hectares of land. In 1930, the minimum treshold was decreased into 0.25 hectares, and due to the state of emergency caused by war in 1941 it was increased

[15]The 1930 census was collected both in 1929 and 1930.

[16]Details of aggregated and excluded municipalities are available upon request.

[17]In the 1941 census, the information on landless farmers who owned atleast one animal was collected subsequently. Unfortunately, the quality and coverage of the subsequent material was poor. See Agricultural census 1941 I, page 1–2.

to one hectare (Lento 2010). Because the tenant farms were on the whole smaller than freeholder farms, the alterations could violate the sample's representativeness over time. I argue that it is not much of an issue, since the miniature farms covered less than 4% of the cows and less than 1% of the area under cultivation or the value of agricultural machinery during the sample period, and thus could unlikely make a difference to the results.[18] Alas, the data on agricultural machinery is not available in the 1920 census, due to flaws in the data collection process.

Considering reliability of the data, two issues arise. First, because of food shortage and rationing by the time of 1920 and 1941 censuses, several sources suspect that the census data on area under cultivation could suffer from downward bias due to intentional misreporting.[19] I argue that the suspicion is unlikely relevant for my analysis, since a systematic bias in the coefficients would require that the misreporting was somehow correlated with the tenant shares. A more credible threat is that poorer farms were more likely to downplay the size of their fields, but this distortion should be captured by the baseline controls for farm size. Second, the political situation in Finland cannot be overlooked. As of the late 1930s, Finland fought two wars against the Soviet Union as an offshoot to WWII: the Winter war in 1939–1940 and the Continuation War in 1941–1944. The conflicts affected reliability of the 1941 census, as territorial changes, shortage of resources and the mobilization of farmers had an effect on the data collection process (Lento 2010). Again, I argue that the estimates are improbably biased, since this would imply that the data collection errors were correlated with the instrument. A more credible scenario is, that the conflicts produced some random error in the dependent variables, which would increase the standard errors of the coefficients. Nonetheless, in order to eliminate the uncertainty of the war, I repeat the analysis while restricting the sample to the period 1910–1930.

The definition of the key dependent variables is the following. Capital intensity is defined as the real value of the most common agricultural machinery by the time,

[18]With miniature farms I am referring to farms with 0.25 to 1 hectares of own land. With respect to machinery, the calculation is based on farms which had 0.25 to 2 hectares of own land. See Agricultural census 1930 I, page 13; Agricultural census 1930 II, page 52 and Agricultural census 1930 III, page 43.

[19]See Lento (2010) or Peltonen (1987).

namely treshers, reapers and rakes per rural employee in thousands of 1930 Finnish marks. The employment data I got from *Population by Industry and Commune in 1880–1975*. Similarly, machines per field is the real value of the enumerated machinery per hectare of field. The unit price for each machine I computed using industrial statistics in 1930. Land per labour ratio is the field in hectares per rural employee. The structural composition of agriculture I have proxied with the number of cows per hectare of field. When this ratio increases, I have interpreted it as an increase in the relative importance of dairy farming at the expense of grain growing. Graphical support for the proxy's accuracy is represented in Figure 4. At least the aggregate series of cows per field and the gross output share of dairy farming appear to be interconnected. Correlation between the two variables is 0.58.

Next, I describe the construction of the explanatory variables. As the instrument, I use tenants as a share of all farms in 1910. Farm size is measured as field in hectares per farm in 1910. Population density is the number of people per square kilometer in 1911, which I collected from the 1913 edition of *Statistical Yearbook of Finland*. Soil variables are expressed as the fraction of field under the respective soil type. Clay soil represents nutrient-rich soil while sand soil is arid. The soil variables are measured in 1941, but following Nunn and Qian (2011), I argue that they are fixed characteristics and thus predetermined from the treatment's perspective. Weather indicators were scraped from annual agricultural censuses in 1910, 1918, 1930 and 1940.[20] Unfortunately, growing season means[21] of temperature and rainfall were available only for 8 to 27 municipalities. I imputed missing observations based on geographical proximity using the existing data. Finally, the spatial data was kindly provided by Matti Mitrunen. Descriptive statistics of my dataset are presented in Table 1.

[20]The information on temperature or rainfall was not available in the 1920 or 1941 censuses.

[21]Growing season mean is the unweighted average of the monthly values from April to September.

Table 1: Descriptive Statistics

Statistic	N	Mean	St. Dev.
Tenant share	472	0.45	0.24
Machines per employee	1,314	0.64	0.41
Machines per field	1,386	0.26	0.16
Land per employee	1,750	2.46	1.32
Cows per field	1,855	0.69	0.82
Population density	472	16.11	12.99
Clay soil	440	0.31	0.21
Sand soil	441	0.14	0.12
Temperature	1,868	11.57	1.16
Rainfall	1,868	293.82	40.36
Farm size	1,852	8.51	4.63

Source: Agricultural censuses 1910–1941.

Note: The variables measuring machinery are expressed in thousands of 1930 Finnish markkas.

Figure 4: The Evolution of Gross Output Share of Dairy Farming in Agriculture and Cows per Field in Finland 1910–1940

Notes: Gross output of dairy farming is computed as the sum of gross production of milk, farm butter and beef.
Sources: Viita (1965); Vattula (1983).

6 Results

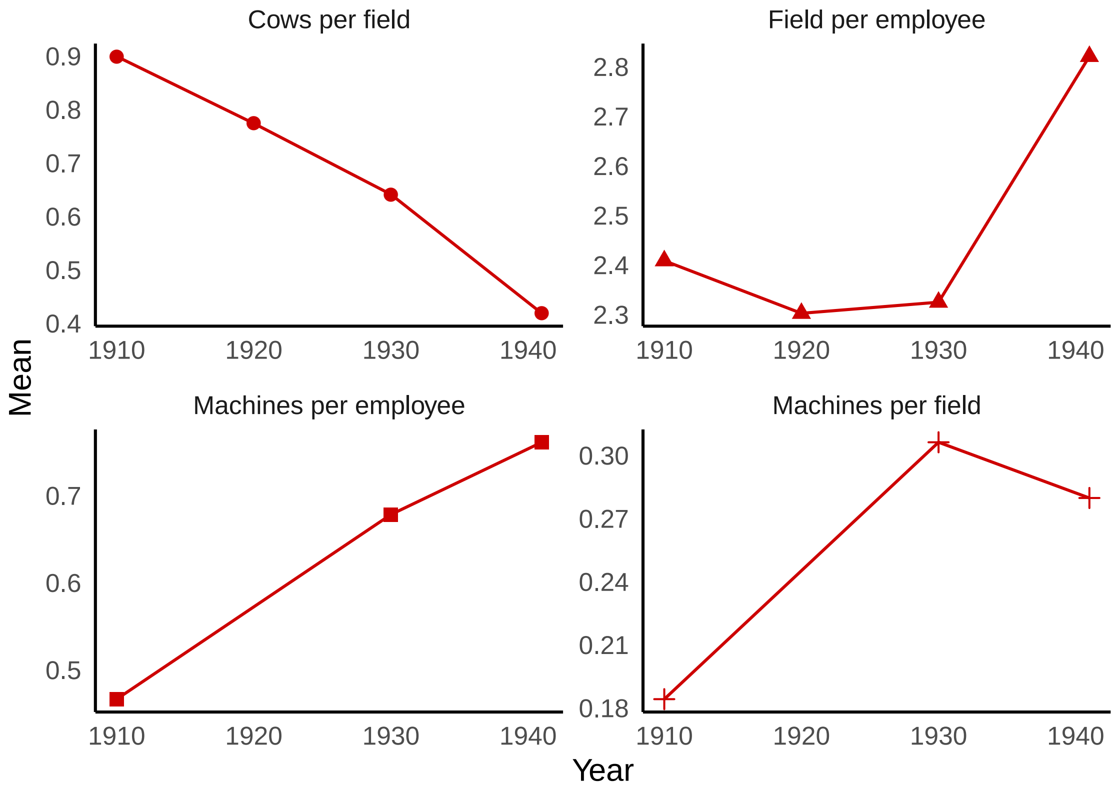
In this section, I present the results of my analysis. I start with descriptive evidence by illustrating the evolution of outcomes on average and by the treatment status. I proceed with the instrumental variables analysis, presenting the reduced form estimates which encapture the causal relation between the land reform, agricultural investment and the production structure. The analysis is followed by robustness checks and a chapter on causal interpretation. I conclude the section with a discussion on the underlying causal mechanisms and a reflection of the results in light of previous research.

Figure 5 graphs the evolution of the main outcomes over the sample period. In the interwar years, agricultural investment soared: the area under cultivation and capital intensity experienced both a significant increase. Over the 30-year interval, field per employee increased by around 17%, while the value of machinery per employee grew by over 60 percent in an average municipality. Although the new land under cultivation was undoubtedly of inferior quality relative to the already cultivated fields, the preconditions for practicing agriculture evidently increased in Finland during the interwar period. This is a familiar story from economic and agricultural history, discussed already in chapter 3.

While the inputs of production reached unforeseen numbers by the early 1940s, Finnish agriculture took otherwise a regressive turn between the wars. Agricultural machinery consisted of familiar items from early nineteen hundreds and quality improvements were scarce. The explicit goal of agricultural policy was autarchy, which was pursued by subsidies for grain exports and pioneer farming. The subsidy policy intensified in the 1930s, partly explaining the simultaneous upsurge in field per employee. Because of the policy bias toward the growing of cereals, the number of cows per field slumped from 1910 to 1941, apparent in the top left panel of Figure 5.[22] Moreover, an increase in feed per cow lead to the moderation of the growth rate of the livestock. In the interwar years, Finnish agriculture grew by volumes and its structure was steered towards self-sufficiency by the state.

[22]The policy change of 1930s is also evident in the sudden decrease of gross output share of dairy farming, apparent in Figure 4.

Figure 5: The Evolution of Agricultural Outcomes on Average Municipality 1910–1941



Notes: Each point corresponds to an unweighted average of the variable in question. Variables per field are expressed per one hundred hectares.
Sources: Agricultural censuses 1910–1941; *Population by Industry and Commune in 1880–1975*.

As a first glance to the potential effect of the land reform, Figure 6 depicts the development of the outcome variables in the top and bottom quantiles of municipalities by tenant share. The top quintile consisted of municipalities with a tenant share of atleast 64%, while in the bottom quantile the shares were less than 23%. After accounting for missing observations, both quantiles represent roughly a hundred municipalities. Figure 6 demonstrates, that the observed increase in capital intensity was faster in municipalities with the the most tenants: over the sample period, the top quantile passed the bottom quantile municipalities after starting as less mechanized in 1910. With respect to machines per field the catch-up is not as distinct, but still visible. Furthermore, field-employee ratio experienced a temporary reduction in the top quintile between the wars, but recovered ultimately to its 1910 level in 1941. In contrast, the ratio grew by almost 15% in the bottom quintile. The number of cows per field shrank notably more in the municipalities with the lowest tenant shares, especially after 1920. Recapitulating, the graphical evidence suggests that capital intensity boomed and the structural change favored dairy farming in municipalities with higher tenant shares post-reform. In contrast, investment in land took place predominantly in municipalities with lower tenant shares after the land reform. This visualization summarizes the key findings of the thesis.

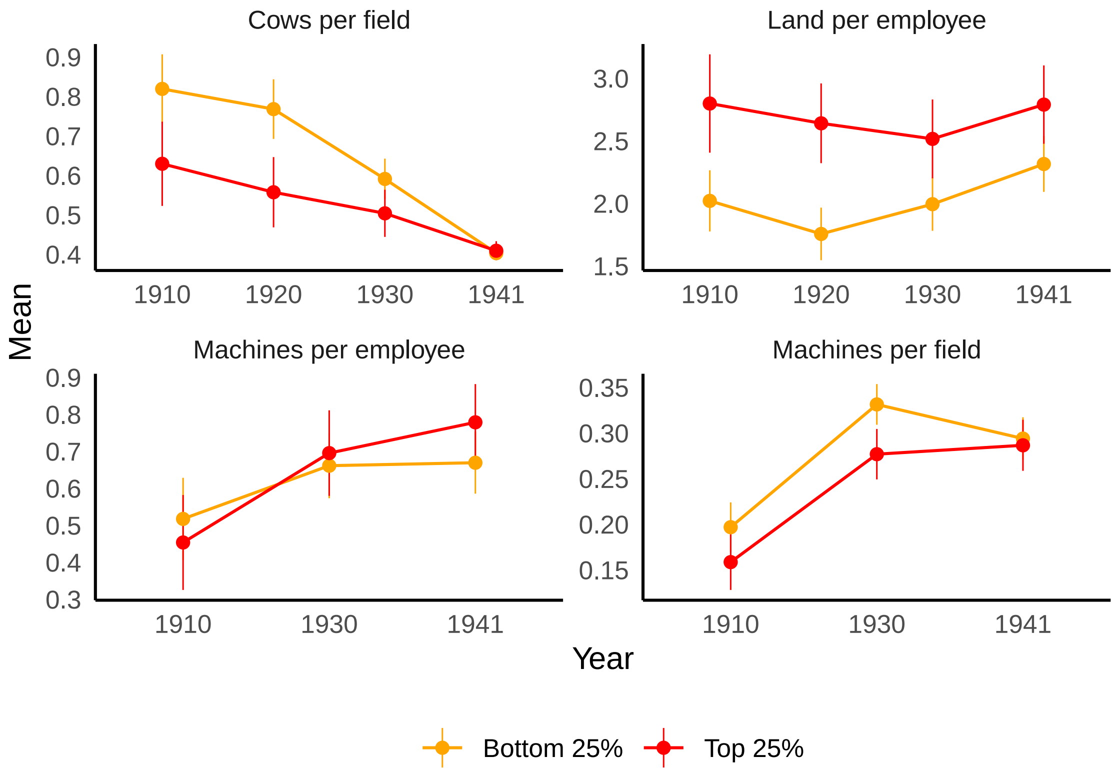
6.1 Main Results

Next I continue to describe the main results. Columns 1–4 in Table 2 report estimates from the baseline specification (4) for each outcome. Affirming the visual inspection, the estimates show that the land reform increased capital intensity and pushed production structure toward dairy farming at the municipal level. These effects are statistically significant at the 1% level. Moreover, the reform appears to have also decreased land investment, but the estimate is rather imprecise and statistically insignificant at conventional levels.

To comment on relationships of the other covariates, surprisingly, farm size correlated positively with structural transformation toward dairy production, and yet negatively with land and capital investment. In another words, greater baseline wealth appears to have *decreased* investment after the land reform. I suspect that the underlying reason was inefficient management of large farms: having high overall returns to begin with, they were indifferent of keeping up with the technological frontier.[23] Again unexpectedly, population density had a strongly significant negative connection with machinery investment. Instead of accelerating the diffusion of technology, initially high population density slowed down mechanization post-reform. Since labour was an abundant factor in densely populated areas, its price was likely low which could have discouraged capital investment.[24] The prevalence

[23] For an extended treatment of the importance of overall return, see Banerjee and Duflo (2011).
[24] See e.g. Federico (2008, p. 228).

Figure 6: The Evolution of Agricultural Outcomes by Tenant Share 1910–1941



Notes: Each point corresponds to a weighted average of the variable in question, were the numbers of farms by municipality in 1910 have served as weights. The red lines denote the quarter of municipalities with the highest proportion of tenants in 1910, while the orange lines mark the bottom quarter. The vertical lines represent 95% confidence intervals, calculated using robust standard errors.
Sources: Agricultural censuses 1910–1941; *Population by Industry and Commune in 1880–1975.*

of qualitatively superior clay soil was negatively associated with cows-field ratio, but positively associated with field-employee ratio. These correlations are probably due to the soil's influence on comparative advantage, considering that the nutrient-poor sand soil had exactly the opposite effect: grain growing was popular on fertile lands, while dairy farming was favored in arid places. The correlation between clay soil and capital investment was more ambiguous, but it seems that an increase in the extent of sand soil consistently increased machinery investment, suggesting that investment was used to even out natural conditions. Similarly, temperature had a

Table 2: Effect of the Land Reform on Agricultural Investment and Production Structure

	Dependent variable:			
	Cows/X	Land/L	Machines/L	Machines/X
	(1)	(2)	(3)	(4)
Bartik	0.70***	−0.42	1.16***	1.21***
	(0.18)	(0.30)	(0.44)	(0.33)
Post × Farm size	0.39***	−0.34***	−0.47***	−0.03
	(0.03)	(0.05)	(0.09)	(0.07)
Post × Population density	0.002	−0.01	−0.39***	−0.35***
	(0.02)	(0.03)	(0.07)	(0.07)
Post × Clay soil	−0.20**	0.35**	0.45*	−0.08
	(0.08)	(0.15)	(0.26)	(0.21)
Post × Sand soil	0.12	−0.07	1.44***	1.33***
	(0.10)	(0.18)	(0.35)	(0.30)
Temperature	−0.76***	1.05***	−1.33**	−3.75***
	(0.22)	(0.31)	(0.59)	(0.56)
Rainfall	0.14**	−0.03	0.52***	0.27***
	(0.06)	(0.07)	(0.13)	(0.09)
Municipality fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	1,746	1,735	1,292	1,301
Adjusted R^2	0.79	0.76	0.84	0.75

Note: The unit of observation is a municipality. *Bartik* is a municipality-level measure of the intensity of the land reform. All variables are expressed in logs, except for *Bartik*, clay soil and sand soil, which are expressed in proportions. All regressions are weighted by the number of farms in 1910. Robust standard errors in parentheses, clustered at the municipality level.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

negative relation and rainfall a positive relation with machinery investment: the worse the weather, the more there appeared to be compensatory investment.

To provide a closer look of the results, I have rerun the baseline specifications with other related outcomes or disaggregations of the dependent variables in Table 3. Column 1 shows, that the land reform indeed squeezed the average farm size markedly, as proposed in previous literature. Although transforming the tenants' leases into titles could not shrink farm sizes per se, the underlying reason was probably the emergence of thousands of new small farms, bought by cottagers and the landless population. Disaggregating the land reform's positive causal effect on capital investment, columns 2–4 reveal that the impact was not entirely uniform: the number of rakes per employee appears to have decreased due to the reform, albeit the estimate is statistically insignificant. The reform-based upsurge in capital intensity was primarily driven by an increase in the most common type of agricultural machinery, reapers, and secondarily by treshers. Curiously, according to column 5 the land reform also *decreased* the employment share in primary production. My interpretation of the regression in column 5 is, that the reform did not slow down the structural transformation of the affected municipalities, what is sometimes suggested in earlier research.

Table 3: Effect of the Land Reform on Other Agricultural Outcomes

	Dependent variable:				
	Farm size	Rakes/L	Reapers/L	Treshers/L	Primary employment
	(1)	(2)	(3)	(4)	(5)
Bartik	-0.98^{***}	-0.74	1.47^{***}	0.99	-0.20^{*}
	(0.16)	(0.52)	(0.40)	(0.67)	(0.11)
Post × Farm size	-0.39^{***}	-0.71^{***}	-0.43^{***}	-0.49^{***}	0.01
	(0.03)	(0.10)	(0.08)	(0.13)	(0.02)
Post × Population density	0.04	-0.03	-0.27^{***}	-0.62^{***}	-0.01
	(0.02)	(0.09)	(0.06)	(0.10)	(0.01)
Post × Clay soil	0.18^{**}	0.001	0.36	0.83^{**}	-0.08
	(0.09)	(0.27)	(0.23)	(0.40)	(0.06)
Post × Sand soil	-0.20	0.02	1.62^{***}	1.73^{***}	-0.07
	(0.12)	(0.35)	(0.33)	(0.51)	(0.09)
Temperature	1.66^{***}	-1.73^{**}	-1.38^{**}	-1.83^{**}	0.09
	(0.22)	(0.69)	(0.58)	(0.77)	(0.11)
Rainfall	-0.05	0.07	0.37^{***}	0.95^{***}	-0.002
	(0.05)	(0.15)	(0.12)	(0.19)	(0.03)
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	1,745	1,269	1,291	1,282	1,736
Adjusted R^2	0.76	0.87	0.83	0.79	0.68

Note: The unit of observation is a municipality. *Bartik* is a municipality-level measure of the intensity of the land reform. All variables are expressed in logs, except for *Bartik*, clay soil and sand soil, which are expressed in proportions. All regressions are weighted by the number of farms in 1910. Robust standard errors in parentheses, clustered at the municipality level.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 4: Difference in Agricultural Investment and Production Structure by Tenant Share, Relative to 1910

	Dependent variable:			
	Cows/X	Land/L	Machines/L	Machines/X
	(1)	(2)	(3)	(4)
1920 × Tenant share	-0.20^{***}	0.18^{**}		
	(0.06)	(0.09)		
1930 × Tenant share	0.03	-0.10	0.29^{**}	0.38^{***}
	(0.05)	(0.09)	(0.14)	(0.11)
1940 × Tenant share	0.27^{***}	-0.09	0.50^{***}	0.47^{***}
	(0.08)	(0.14)	(0.18)	(0.13)
Controls	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	1,746	1,735	1,292	1,301
Adjusted R^2	0.80	0.76	0.84	0.75

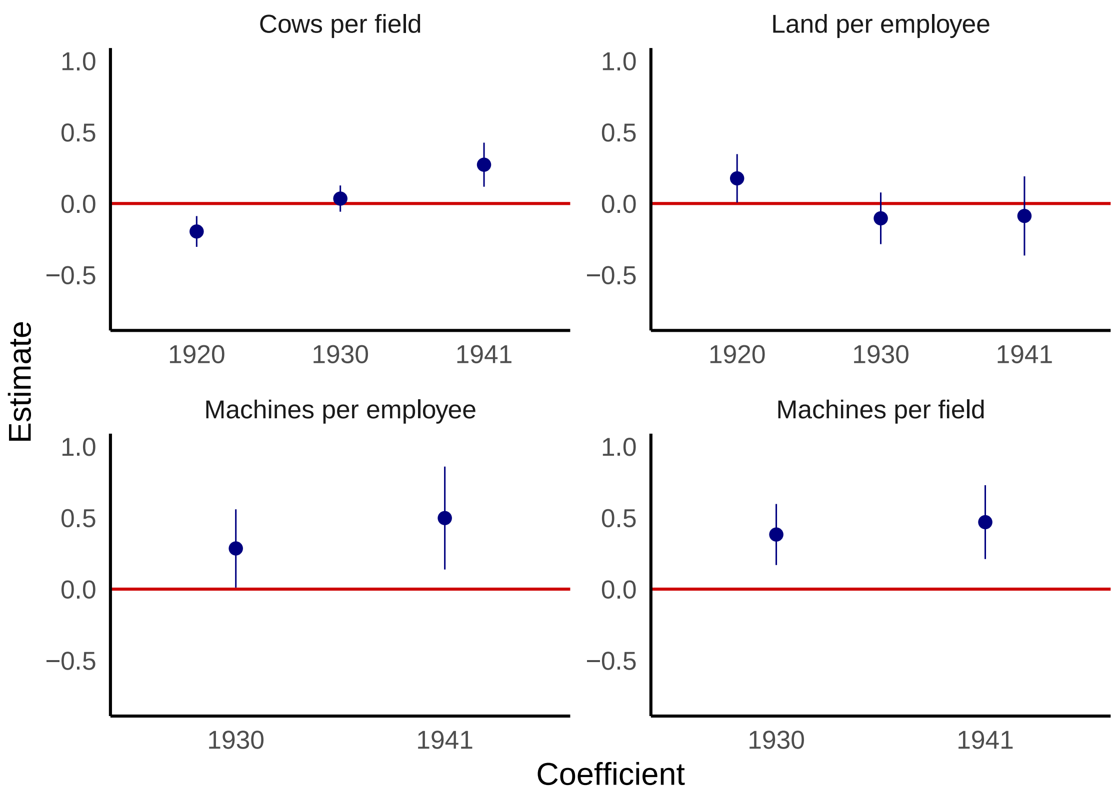
Note: The unit of observation is a municipality. Tenant share measures tenants as a share of all farms in 1910. Controls include log farm size in 1910, log population density in 1910, the field under sand soil and the field under clay soil, each interacted with the post-reform dummy, as well as log temperature, log rainfall, municipal fixed effects and time fixed effects. All regressions are weighted by the number of farms in 1910. Robust standard errors in parentheses, clustered at the municipality level.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

An interesting aspect to consider is the evolution of the land reform's effect over time. Table 4 displays regressions otherwise identical to Table 2, but where the treatment variable has been exchanged to an interaction of the tenant share and the year dummies. According to these dynamic estimates, the main causal effects grew larger over time. The magnification of machinery investment could be explained by lags in investment decisions: once the ex-tenants had bought their farms, they might have decided to wait out before making another likely loan-financed investment. The same argument applies to the shifting production structure, which was costly and time-consuming. The coefficients of Table 4 are also illustrated in Figure 7.

Overall, the results suggest that the land reform increased capital investment and pushed the production structure of agriculture towards dairy farming. In addition,

Figure 7: Dynamic Effects of the Land Reform on Agricultural Outcomes 1910–1941



Notes: Each point corresponds to a reduced form coefficient from equation (4). The outcome is regressed on the variable of interest, $T_{m,1910} \times \mu_t$, along with log farm size in 1910, log population density in 1910, the field under sand soil and the field under clay soil, each interacted with the post-reform dummy, as well as log temperature, log rainfall, municipal fixed effects and time fixed effects. All regressions have been weighted by the number of farms in 1910. The blue vertical lines represent 95% coefficient intervals, calculated using robust standard errors, which have been clustered at the municipality level. The red horizontal line demonstrates a null effect.

the reform appears to have reduced investment on land, though the estimate was imprecise. Still, the reduction is consistent with the changing structural composition. Relying on previous research, I argue that the causal mechanism driving the results was an improvement in the former tenants' property rights. As elaborated in chapter 2, before the reform the crofters had poor incentives to invest as they were troubled by insecurity. Often they were unable to invest due to the lack of inadequate funds and collaterals. On the other hand, the landowners had little motivation to mechanize because labour was relatively cheap. The land reform abolished the above issues. Unfortunately, on the basis of the analysis above, it is impossible to distinguish the mechanism's subtleties, i.e. the relative importance of incentives or the collateralizability assets.

To provide a sense of magnitude of the results, note that in an average municipality, the *Bartik* measure increased by 0.181 units from 1910 to 1941. According to the benchmark estimate in Table 2, this corresponds to a $\exp(1.161 \times 0.181) - 1 \approx 23\%$ increase in capital intensity. Assuming that the land reform's effect on capital intensity approximately reflects its impact on overall effort, the reform's *ceteris paribus* effect on output in terms of the model in chapter 3 would be

$$\begin{aligned}\frac{y_1}{y_0} - 1 =& \frac{A\sqrt{e_1}}{A\sqrt{e_0}} - 1 = \frac{A\sqrt{e}}{A\sqrt{(1-0.234)e}} - 1\\ =&0.766^{-\frac{1}{2}} - 1\\ \approx&14.3\%\end{aligned}$$

In another words, according to the model, the land reform increased output at the farm level by circa 14 percent in the interwar period. This was a substantial improvement in the peasants' standard of living.

Considering the structural transformation of agriculture, I evaluate its economic significance using a counterfactual scenario. Suppose that the relationship between cows per field and the gross output share of dairy farming is linear. Using time series data from Figure 4, I can produce a rough guess of the relation in 1910–1940

$$\text{gross output share of dairy farming}_t = 23.57 + 67.11\left(\frac{Cows}{X}\right)_t + \hat{\varepsilon}_t$$
$$n = 31 \qquad Adj.R^2 = 0.32$$

where $\hat{\varepsilon}$ is a residual. Utilizing again the benchmark estimates in Table 2, I compute that the land reform increased the cows per field ratio by $\exp(0.700 \times 0.181) - 1 \approx 13.5$ percent. Thus according to the regression line above, the gross output share of dairy farming in 1941 would be $67.11 \times 0.135 \times \left(\frac{Cows}{X}\right)_{1941} \approx 3.5$ percentage points lower in a counterfactual world where the land reform was never implemented. Since the gross output share of dairy farming grew in 1860–1960 by 0.35 percentage points a year, in the counterfactual world the stuctural transformation of agriculture would lag $3.5/0.35 \approx 10$ years behind the observed progress.[25]

Robustness

In this section I study the robustness of my results. I restrict the sensitivity analysis on estimates which provided evidence against the null hypothesis in the benchmark regressions. According to the analysis so far, the land reform appears to have increased machinery investment and pushed the structural composition of agriculture toward dairy farming, conditional on natural conditions, population density and average wealth. One empirical concern is functional form of the relation between wealth and investment. If the farmers were liquidity constraint so that machines or livestock could be bought only after certain wealth treshold was surpassed, then the average wealth captures poorly the significance of wealth in determining the outcomes.[26] To address this concern, I include an interaction which controls for the proportion of farms which had less than 10 hectares of land, $post_t \times smallfarms_{m,1910}$. These otherwise identical specifications to the baseline are represented in columns 1 and 2 of Table 5. The additional control has little effect on the coefficient of the *Bartik* measure. Another complication related to functional form is the treatment of zeros in the dependent variable: in handful of municipalities the number of livestock or machinery was zero, which makes the logarithm undefined. In columns 3 and 4, I show that the causal estimates are robust to using the inverse hyperbolic sine transformation of the dependent variables.

[25] Alternatively, I could omit the intercept from the auxiliary regression to force the gross output share of dairy farming to zero when the number of cows is zero. Doing this would translate into 5.7 percentage points lower gross output share of dairy farming in a counterfactual world.

[26] Banerjee and Duflo (2005) provide a thorough discussion of the connection between income distribution and investment.

Table 5: Sensitivity Analysis

	Small farms		IHS		Coordinates		Conley SEs		Area	
	Cows/X	Machines/L	Cows/X	Machines/L	Cows/X	Machines/L	Cows/X	Machines/L	Cows/X	Machines/L
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bartik	0.73***	1.07***	0.42***	0.47***	0.59***	2.09***	0.96***	0.92*	0.69***	1.16***
	(0.18)	(0.41)	(0.12)	(0.15)	(0.19)	(0.42)	(0.31)	(0.49)	(0.18)	(0.44)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,744	1,290	1,746	1,302	1,746	1,292	1,746	1,292	1,746	1,292
Adjusted R^2	0.80	0.85	0.77	0.81	0.80	0.87	-	-	0.80	0.84

Note: The unit of observation is a municipality. *Bartik* is a municipality-level measure of the intensity of the land reform. Controls include log farm size in 1910, log population density in 1910, the field under sand soil and the field under clay soil, each interacted with the post-reform dummy, as well as log temperature, log rainfall, municipal fixed effects and time fixed effects. All variables are expressed in logs, except for *Bartik*, clay soil, sand soil, and the fraction of small farms, which are expressed in proportions. Coordinates are expressed in degrees. Regressions in columns 1–6 and 9–10 are weighted by the number of farms in 1910, and report robust standard errors in parentheses, clustered at the municipality level. Regressions in columns 7–8 report spatial HAC standard errors in parentheses, adjusted for spatial correlation within 60 kilometer radius.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

In columns 5 and 6 I control for the time-variant effect of longitude and latitude defined by the municipalities' centroids. Since the municipalities with higher tenant shares were somewhat spatially concentrated on the Southern provinces of Turku and Pori and Häme, it is important to ensure that the coefficient of the *Bartik* measure is not produced by regional trends. Columns 5–6 demonstrate that this is not the case. Another issue brought about by the threat of spatial concentration is spatial correlation of the error term (Conley 1999). To consider this, I have re-estimated the baseline specifications using spatial HAC standard errors in columns 7 and 8. Following Mitrunen, Virkola, and Meriläinen (2019), I allowed spatial correlation within 60 kilometer radius. The coefficient of the *Bartik* measure remains statistically significant at the 10% level.[27] A graphical inspection of the geographical nature of the effects is presented in Figure 8. Despite the regional pattern of the crofter system, geography does not seem to drive the results.

Over the twenty years after gaining independence, Finland went through a considerable number of territorial changes in terms of municipal separations and cession of territories. The redefinition of municipal borders could affect the outcomes in a way that does not reflect behavioural responses. In columns 9 to 10, I account for this potential bias by controlling for the log of the area of each municipality over time. The results remain unchanged.

Finally, columns 1–4 in Appendix Table A1 show, that the estimates are robust to measuring the dependent variables in levels or excluding possibly influential observations based on Cook's distance. As a cut-off point for the latter, I excluded observations with a distance exceeding $4/n$.[28] In columns 5–6, I have implemented the gross precaution of excluding the 1940 cross section entirely. While the effect on capital intensity is still statistically significant at the 5% level, the impact on production structure is now insignificant. In my opinion, this is reasonable as the dynamic estimates demonstrated the sluggish nature of the structural transformation. In total, the results appear robust.

[27] The results were qualitatively similar when the cutoff distance was doubled.

[28] See Vehkalahti and Everitt (2018, Chapter 4) or Fox (2019, Chapter 4).

6.2 Causality

One important concern that could invalidate the causal interpretation of the above findings is the possibility of differential trends in outcomes by tenant share preceding the land reform. In this subchapter, I check for balance in pre-treatment outcomes (Angrist and Pischke 2015, Chapter 3; Stock and Watson 2015, Chapter 13). If the municipalities with higher tenant shares were more capital intensive and specialized in dairy farming already before 1919, my estimates could simply capture differences in underlying long-term trends. I explore baseline differences in outcomes by estimating a cross-sectional equivalent of equation (4) with pre-treatment data for 1910:

$$y_m = \alpha + \beta T_m + \mathbf{x'}_m \boldsymbol{\gamma} + \epsilon_m \tag{6}$$

where y_m is the outcome and T_m is the tenant share in municipality m, as before. $\mathbf{x'}_m$ is a vector of controls, including log average farm size, log population density, the field under sand soil, the field under clay soil, log mean temperature of the growing season and log mean rainfall of the growing season.

Table 6 reports the baseline differences in outcomes by treatment status. Column 3 shows, that municipalities were indeed somewhat systematically different with respect to the tenant shares, even after conditioning on covariates. In contrast to the above analysis, municipalities with higher tenant shares *lagged behind* in capital intensity before the land reform, suggested already by Figure 6. The lag was solely caused by the scant utilization of reapers: keeping the covariates constant, a fictitious municipality with a tenant share of 100% had 1.18 log points (or almost 70 percent) less reapers per rural employee relative to a municipality with no tenant farmers in 1910. Considering other outcomes, the differences are small and statistically insignificant.

To sum up the examination of baseline differences, it seems that the municipalities with higher tenant shares were significantly less mechanized before the land reform, when taking into account the superior natural conditions and mean wealth. The found discrepancy is in tune with the causal mechanism I am proposing. My claim is that the degree of mechanization at the municipal level is at least partly determined by the uncertainty of the farmers' property rights. Since the property rights of the

Table 6: Baseline Municipality Characteristics, by Tenant Share

		Differences by Tenant Share	
	Mean in 1910	Bivariate	Controls
Cows/X	0.81***	−0.27***	0.03
	(0.03)	(0.09)	(0.07)
Field/L	2.38***	0.61***	0.11
	(0.09)	(0.14)	(0.08)
Machines per employee	0.44***	0.20	−0.77***
	(0.02)	(0.28)	(0.19)
Machines per field	0.16***	−0.22	−0.88***
	(0.01)	(0.15)	(0.16)
Rakes/L	0.03***	0.58*	−0.01
	(0.002)	(0.35)	(0.23)
Reapers/L	0.07***	−0.59**	−1.18***
	(0.004)	(0.25)	(0.18)
Primary employment	0.85***	0.01	0.04
	(0.01)	(0.05)	(0.04)
Treshers/L	0.04***	1.39***	−0.06
	(0.002)	(0.37)	(0.28)

Note: Column 1 reports average baseline municipality characteristics in 1910. All variables are expressed in levels. Column 2 reports the difference for each municipality characteristic in logs by tenant share in 1910. Column 3 reports the estimated difference in logs when controlling for log population density, the field under sand soil, the field under clay soil, log temperature, log rainfall and log farm size. The averages and differences have been estimated while weighting by the number of farms. Robust standard errors in parentheses.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

tenants were insecure, it is logical that capital investment lagged behind ex-ante in municipalities where the crofter system was prevalent. The difference is also sensible in the light of historical studies on the crofter system. In municipalities with above average tenant shares the incentives to mechanize were low in the eyes' of scholars.[29]

From the baseline differences in outcome levels one can conclude that the municipalities with higher tenant shares had an initial disadvantage in terms of machinery investment, implying that they invested less on average at least until 1910. Nonetheless, on the basis of levels it cannot be ruled out that the differences were already fading away before the land reform. Addressing possible differences in pre-trends would require multiple pre-reform observations, which are unfortunately unavailable due to the lack of data. The most I can say is, that the land reform increased machinery investment and changed the structural composition of agriculture conditional on the usual suspects, such as the differences in natural conditions, population density and wealth.

6.3 Discussion

According to the above analysis, it seems that the land reform had a positive causal effect on capital intensity at the municipal level. Addedly, the reform appears that to have sped up agriculture's structural transformation towards dairy farming. Based on a extremely simplistic model of the relationship between property rights and economic output, the reform increased agricultural output at the farm level by around 14%. In this section, I will discuss the results in the light of previous literature on the Finnish land reform and also land reforms in general.

Above I calculated that after its implementation in 1919, the land reform increased capital intensity by 23% over the following two decades. My results are roughly consistent with two recent studies based on RCTs. Firstly, the outcome comes quite close to Burchardi et al. (2018), who find that increasing the output share of Ugandan tenants from 50 to 75 percent increased their use of agricultural tools by 29%. It is also in the same ballpark as Goldstein, Houngbedji, et al. (2018)'s findings, according to which parcels in demarcated communities increased their long-

[29] See chapter 2.

term investment by 24 to 43 percent in Benin. The Finnish reform has elements comparable to both aforementioned experiments. Like in Uganda, the output share of former tenants did increase, as the ex-tenants were no longer obliged to pay rents after buying their farms. The proportional increase was also of similar magnitude, since the average rental stress was around 30–40% of the tenant's net production before the reform (Peltonen 2004). Of course, in contrast to the Ugandan experiment Finnish farmers had to cover the redemption price. Similar to Benin, security over the tenants' inputs increased, as their leases transformed into titles. In Benin, the demarcation made the farmers' property rights more secure by decreasing the risk of land seizure.

Although the Finnish land reform is contextually miles away from experiments carried out in Africa a century later, because of analogous effect on incentives they seem to yield outcomes of similar magnitude. An important distinction to note is, that in the Finnish case we can conclude that the reform's impact on investment is persistent even twenty years after the reform.

Before the land reform, municipalities with widely established crofter system were in poor position to invest. Because leases were short and evictions prevalent, the tenants were afraid to invest: the fruits of saving could go to waste. At times, they might be simply unable to invest. The most common type of agricultural machinery, the reaper, was unaffordable to small farms (Niemelä 2008, p. 150). Due to the lack of collateralizable assets, it was "impossible for a crofter to fund investment by a bank loan" (Peltonen 2004).

In municipalities with high tenant shares, also the landowners had little incentive to invest. The abundant supply of cheap and flexible labour decreased the benefits of labour-saving machinery investment (Alapuro 2018, p. 47). Although selling the crofts could have increased overall output by improving the efficiency of production, the crofter system was more profitable from the landowners' perspective and thus persisted.

The land reform eliminated the aforementioned problems concerning incentives and liquidity constraints. Once the ex-tenants owned their land, acquiring machinery became both safer and more feasible. For one, the risk of reselling expensive machines went down, as their usage no longer depended on uncertain tenancy agreements. For two, banks became suddenly willing to grant loans as the farms could be pledged as securities. And for three, when the landowners lost access to cheap and flexible labour, mechanizing the production became abruptly a lot more profitable.

The booming capital intensity came about simultaneously with a structural shift toward dairy farming. The coincidence is logical, as agricultural machinery complemented almost exclusively the cultivation of feed crops, such as hay and oat. While haymaking was done by horse-drawn reapers and rakes, in grain harvest farmers utilized sickles or scythes to maximize yields (Peltonen 2019). Increasing popularity of dairy farming was a longer trajectory in Finnish agriculture, which really intensified as of the 1880s because of the so called grain invasion. In a globalized world the structural transformation was inescapable: the comparative advantage of Finnish agriculture was not in field cultivation. As the Finnish agriculture took a regressive turn toward autarkic grain growing between the wars, the municipalities with higher tenant shares were more likely to continue in commercialized dairy farming. My interpretation is, that the specialized production structure was another manifestation of an incentive-driven increase in effort in the former tenant municipalities. If not caused by incentives, the structural change may also have been mediated by the reduction in mean farm size. In fact, small-scale farming was considered relatively competitive in dairy production by Agrarian Committee, a comtemporary expert body (Niemelä 2008, pp. 129–130). As strongly complementary processes, the structural shift and mechanization naturally stimulated each other.

Based on my results, one cannot distinguish what was the exact mechanism driving the increase in capital intensity caused by the land reform. It could be, that the drastic change in the relative price of labour forced the old landowners to mechanize production.[30] However, this goes against qualitative evidence. According to agricultural censuses, capital intensity in small farms grew faster than in large farms post-reform, which would suggest that the smaller ex-tenant farms were driving the growth of mechanization.[31] Another potential mechanism is the exchange of collateralizable assets, which enabled the peasants to fund investments by bank loans. Based on previous literature, the possibility to get bank loans was a pivotal change,

[30] An explanation brought up by Ahvenainen, Pihkala, and Rasila (1982, p. 209).

[31] That is, the ratio of capital intensity in farms which had less than 10 hectares of land to capital intensity in all the other farms increased.

but so was the incentive effect of private ownership. Unfortunately, the above analysis leaves the relative importance of collateralizability and incentives unsolved.

Nevertheless, the results of this study do suggest that the Finnish land reform caused an acceleration in the mechanization and structural transformation of Finnish agriculture. Based on my calculation, the reform increased agricultural output by around 14% at the farm level, in addition to the distributional effects it undoubtedly had.[32] Accordingly, the income formation of peasants was superior to any other segment of population during the interwar years (Niemelä 2008, p. 173; Hjerppe 1988, p. 71). The increasing standard of living materialized in the lives of populace in the form of lower infant mortality, or in the ability to acquire novel consumables, such as bicycles, factory-made sports gear or movie tickets, among other things (Ahvenainen, Pihkala, and Rasila 1982, p. 311).

My results also consolidate the large body of evidence on the economic benefits of land reforms. On the basis of the Finnish experience, I would conclude that the abolishment of sharecropping appears to lead to efficiency improvements, alongside the likely alleviation of poverty due to distributional effects. The improvements materialize in spite of a shift toward family farming, and do not slow down the structural transition of the economy. Most importantly, the reform's effects seem to persist. Even so, one has to be careful with the external validity of the results. It cannot be ruled out that the results are contingent on other institutional factors specific to Finnish economy at the time, such as the availability of microcredits in terms of credit cooperatives.

Institutions have gained ground as the most plausible primus motor of long-term economic growth.[33] This paper also contributes to the growing literature on which precise policies may define good institutions and foster prosperity.[34] As the studies of North (1991), Acemoglu, Johnson, and Robinson (2001), Acemoglu, Johnson, and Robinson (2005) and Rodrik, Subramanian, and Trebbi (2004) have illustrated the significance of institutions in causing growth in general, a natural next step is to

[32] Illustratively, Roikonen and Heikkinen (2018) find that the income-based Gini coefficient decreased by over 30% from 1904 to 1934.

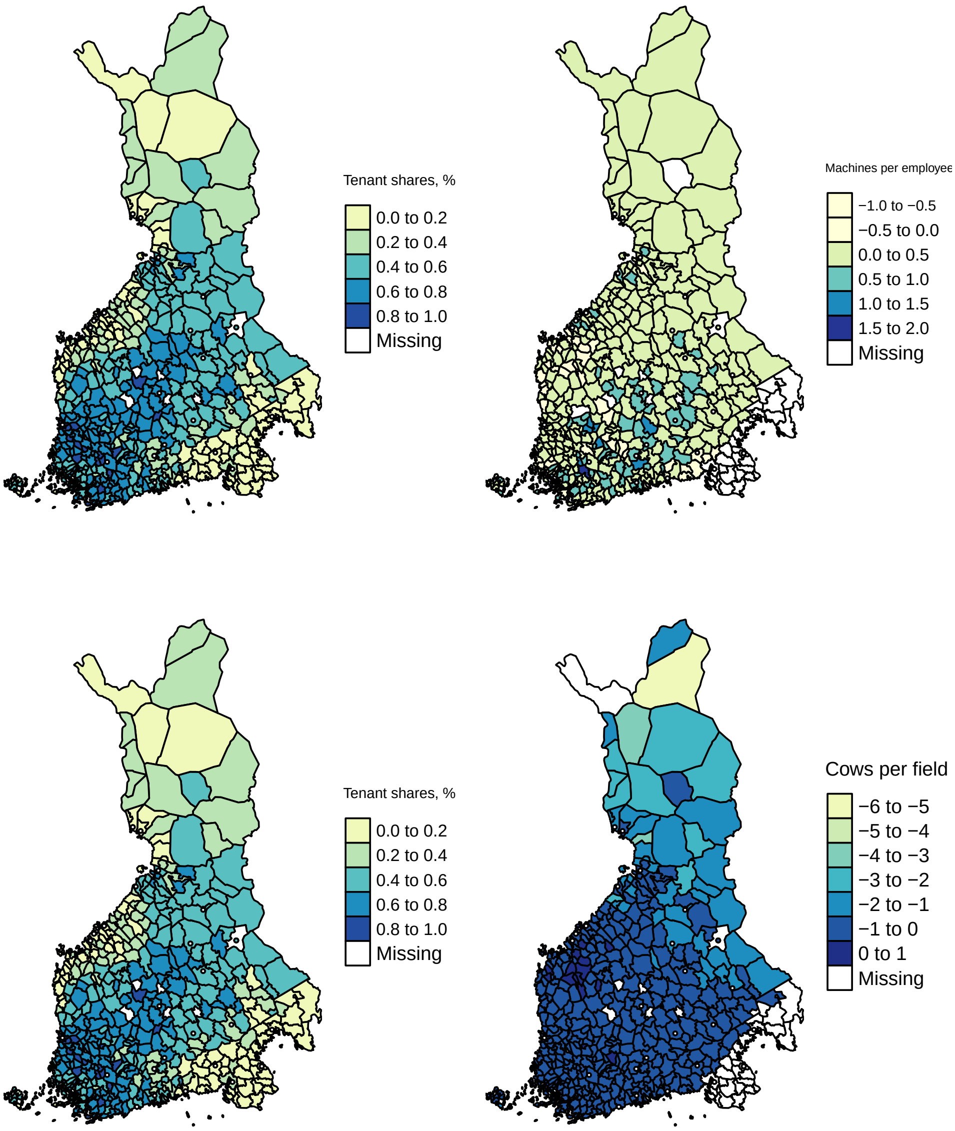
[33] For an extensive discussion on institutions and other possible determinants of growth, see Helpman (2009) or Acemoglu and Robinson (2012).

[34] Banerjee and Duflo (2011).

investigate *which* institutions could spur economic development in particular.[35]

[35] For a recent discussion on the connection between institutions and development in Finnish context, see Koponen and Saaritsa (2019).

Figure 8: Geographical Distribution of Tenant Shares and Changes in Outcomes 1910–1941



Notes: Maps on the right visualize changes in levels of the respective outcome variables from 1910 to 1941. Maps on the left show the geographical distribution of tenant shares as a reference point.
Sources: Agricultural censuses 1910 and 1941; *Population by Industry and Commune in 1880–1975*; Industrial statistics 1930. The map was kindly provided by Matti Mitrunen.

7 Conclusions

In this thesis I have examined the causal effect of the Finnish land reform of 1918 on subsequent agricultural investment and production structure. I find, that the reform increased capital intensity by approximately 23% in 1920–1941, which corresponds to over third of the overall increase. Using a simple stochastic output model, I evaluate that this would signify a 14% increase in output at the farm level. Moreover, I compute that the reform accelerated the structural transformation of agriculture toward dairy farming by 10 years. The exact mechanism driving the results could not be distinguished. I suspect, that the causal channel operated either through the farmers' improved incentives or an access to collateralizable assets, both dependent on property rights.

My findings extend the previous research on Finnish land reform by offering first rigorous attempt to estimate its *ceteris paribus* effect on economic outcomes. I pursue to identify causality by using instrumental variables analysis while exploiting the regional distribution of pre-treatment tenant shares as an exogenous source of variation in reform intensity. I show that the municipalities where the crofter system was more prevalent before the reform had lower baseline capital intensity, what highlights the drag of tenancy. My results confirm the prior conception that the land reform produced a shift toward family farming by reducing the mean farm size. Yet, my findings are at odds with the view that the reform regressed progress or curbed specialization in Finnish agriculture. On the contrary, I find that the reform increased mechanization and stimulated the long term shift of production structure toward dairy farming. I back the observations with qualitative evidence, according to which tenants and the respective landlords had poor incentives or no money to make machinery or livestock investment before 1918. Taking stock, I suggest that the autarkic development of Finnish agriculture over the interwar period was an outcome of other policies, including tariffs, export subsidies and subsisides for pioneer farming.

My results are in line with evidence on land reforms from developing countries of the day. Especially, the estimated impact on capital intensity is of similar magnitude as Burchardi et al. (2018) report in Uganda and Goldstein, Houngbedji, et al. (2018)

calculate in Benin. As a novel contribution to the international studies on land reforms, I am able to examine the reform's effect for twenty years, and establish that the benefits are persistent. Nonetheless, one should be careful when generalizing the results, as they may be contingent on other institutional aspects of Finnish society at the time, such as a competent credit market.

The Finnish experience demonstrates, that property rights play a key role in the efficiency of agricultural production. I mention two potential mechanisms which could mediate their effect. The first is incentives: once the ex-tenants became full residual claimants of their effort, one would expect the tenants' inputs to increase. The second is collaterals: according to several sources, investment was often unaffordable to tenants pre-reform, but this changed when the tenants could pledge the farms as securities for loans. The relative importance of the two mechanisms is an important avenue for future research. The most I can say is, that property rights matter.

References

Acemoglu, Daron, Johnson, Simon, and Robinson, James (2001). "The Colonial Origins of Comparative Development: An Empirical Investigation." In: *American Economic Review* 91.5, pp. 1369–1401.

— (2005). "The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth." In: *American Economic Review* 95.3, pp. 546–579.

Acemoglu, Daron and Robinson, James (2012). *Why Nations Fail: The Origins of Power, Prosperity, and Poverty.* Crown Books.

Adamopoulos, Tasso and Restuccia, Diego (2019). *Land Reform and Productivity: A Quantitative Analysis with Micro Data.* Tech. rep. National Bureau of Economic Research.

Ahvenainen, Jorma, Pihkala, Erkki, and Rasila, Viljo, eds. (1982). *Suomen taloushistoria. 2: Teollistuva Suomi.* Helsinki: Tammi. ISBN: 978-951-30-5088-7.

Alapuro, Risto (2018). *State and Revolution in Finland.* Brill.

Allen, Robert (2009). *The British Industrial Revolution in Global Perspective.* Cambridge University Press.

Alvaredo, Facundo and Gasparini, Leonardo (2013). "Recent Trends in Inequality and Poverty in Developing Countries." In: *Cedlas, Working Papers* 0151.

Angrist, Joshua David and Pischke, Jörn-Steffen (2009). *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton: Princeton University Press. ISBN: 978-0-691-12034-8 978-0-691-12035-5.

— (2015). *Mastering 'metrics: The Path from Cause to Effect.* Princeton: Princeton University Press. ISBN: 978-0-691-15283-7 978-0-691-15284-4.

Autor, David, Dorn, David, and Hanson, Gordon (2013). "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." In: *American Economic Review* 103.6, pp. 2121–68.

Banerjee, Abhijit and Duflo, Esther (2005). "Growth Theory through the Lens of Development Economics." In: *Handbook of Economic Growth* 1, pp. 473–552.

— (2011). *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty.* Public Affairs.

Banerjee, Abhijit, Gertler, Paul, and Ghatak, Maitreesh (2002). "Empowerment and Efficiency: Tenancy Reform in West Bengal." In: *Journal of Political Economy* 110.2, pp. 239–280.

Banerjee, Abhijit and Iyer, Lakshmi (2005). "History, Institutions, and Economic Performance: The Legacy of Colonial Land Tenure Systems in India." In: *American Economic Review* 95.4, pp. 1190–1213.

Besley, Timothy and Burgess, Robin (2000). "Land Reform, Poverty Reduction, and Growth: Evidence from India." In: *The Quarterly Journal of Economics* 115.2, pp. 389–430.

Besley, Timothy and Ghatak, Maitreesh (2010). "Property Rights and Economic Development." In: *Handbook of Development Economics*. Vol. 5. Elsevier, pp. 4525–4595.

Binswanger-Mkhize, Hans, Bourguignon, Camille, and Brink, Rogier van den (2009). *Agricultural Land Redistribution: Towards Greater Consensus on the "how"*. The World Bank.

Burchardi, Konrad et al. (2018). "Moral Hazard: Experimental Evidence from Tenancy Contracts." In: *The Quarterly Journal of Economics* 134.1, pp. 281–347.

Christiaensen, Luc and Martin, Will (2018). "Agriculture, Structural Transformation and Poverty Reduction: Eight New Insights." In: *World Development* 109.

Conley, Timothy (1999). "GMM Estimation with Cross Sectional Dependence." In: *Journal of Econometrics* 92.1, pp. 1–45.

Eastwood, Robert, Lipton, Michael, and Newell, Andrew (2010). "Farm Size." In: *Handbook of Agricultural Economics* 4, pp. 3323–3397.

Federico, Giovanni (2008). *Feeding the World: An Economic History of Agriculture, 1800-2000*. Princeton University Press.

Fox, John (2019). *Regression Diagnostics: An Introduction*. Vol. 79. SAGE Publications, Incorporated.

Goldsmith-Pinkham, Paul, Sorkin, Isaac, and Swift, Henry (2018). *Bartik Instruments: What, When, Why, and How*. Tech. rep. National Bureau of Economic Research.

Goldstein, Markus, Houngbedji, Kenneth, et al. (2018). “Formalization without Certification? Experimental Evidence on Property Rights and Investment.” In: *Journal of Development Economics* 132, pp. 57–74.

Goldstein, Markus and Udry, Christopher (2008). “The Profits of Power: Land Rights and Agricultural Investment in Ghana.” In: *Journal of Political Economy* 116.6, pp. 981–1022.

Gollin, Douglas, Parente, Stephen, and Rogerson, Richard (2002). “The Role of Agriculture in Development.” In: *American Economic Review* 92.2, pp. 160–164.

Haapala, Pertti and Peltola, Jarmo (2018). “Elinkeinorakenne 1750–2000.” In: *Haapala, Pertti (toim.) Suomen rakennehistoria. Näkökulmia muutokseen ja jatkuvuuteen (1400–2000). Tampere: Vastapaino*, pp. 170–209.

Heikkinen, Sakari (2017). “Kiinniottajasta kiinniotettavaksi: Suomen taloudellisesta kehityksestä 1870-2015.” In: *Kansantaloudellinen aikakauskirja* 113.3.

Helpman, Elhanan (2009). *The Mystery of Economic Growth.* Harvard University Press.

Hjerppe, Riitta (1988). *Suomen talous 1860-1985: Kasvu ja rakennemuutos.* Suomen Pankin julkaisuja 13. Helsinki: Suomen Pankki. ISBN: 978-951-860-941-7.

Hornbeck, Richard and Naidu, Suresh (2014). “When the Levee Breaks: Black Migration and Economic Development in the American South.” In: *American Economic Review* 104.3, pp. 963–90.

Imbens, Guido and Wooldridge, Jeffrey (2009). “Recent Developments in the Econometrics of Program Evaluation.” In: *Journal of Economic Literature* 47.1, pp. 5–86.

Jäntti, Markus, Saari, Juho, and Vartiainen, Juhana (2006). *Growth and Equity in Finland.* 2006/06. WIDER Discussion Papers//World Institute for Development Economics (UNU-WIDER).

Keswell, Malcolm and Carter, Michael (2014). “Poverty and Land Redistribution.” In: *Journal of Development Economics* 110, pp. 250–261.

Koponen, Juhani and Saaritsa, Sakari (2019). *Nälkämaasta Hyvinvointivaltioon: Suomi kehityksen kiinniottajana.* Gaudeamus.

Lento, Katri et al. (2010). *Sata vuotta maatalouslaskentaa.* Tike, Maa-ja metsätalousministeriön tietopalvelukeskus.

Markevich, Andrei and Zhuravskaya, Ekaterina (2018). “The Economic Effects of the Abolition of Serfdom: Evidence from the Russian Empire.” In: *American Economic Review* 108.4-5, pp. 1074–1117.

Mitrunen, Matti (2019). *War Reparations, Structural Change, and Intergenerational Mobility.* Tech. rep. working paper, IIES Stockholm University.

Mitrunen, Matti, Virkola, Tuomo, and Meriläinen, Jaakko (2019). *Tracing Out the Finnish Kuznets Curve: Famine, Threat of Revolution, and Democratization.*

Niemelä, Jari (2008). *Talonpoika toimessaan: Suomen maatalouden historia.* Suomalaisen Kirjallisuuden Seura.

North, Douglass (1991). “Institutions.” In: *Journal of Economic Perspectives* 5.1, pp. 97–112.

Nunn, Nathan and Qian, Nancy (2011). “The Potato’s Contribution to Population and Urbanization: Evidence from a Historical Experiment.” In: *The Quarterly Journal of Economics* 126.2, pp. 593–650.

O’Rourke, Kevin and Williamson, Jeffrey (1999). *Globalization and History: The Evolution of a Nineteenth-century Atlantic Economy.* MIT press.

Ojala, Jari and Nummela, Ilkka (2007). “Pako Malthusin ansasta.” In: *Muutoksen merkit: kvantitatiivisia perspektiivejä Suomen taloushistoriaan.* Helsinki: Tilastokeskus / Statistics Finland.

Olsson, Mats and Svensson, Patrick (2010). “Agricultural Growth and Institutions: Sweden, 1700–1860.” In: *European Review of Economic History* 14.2, pp. 275–304.

Peltonen, Matti (1987). “Maataloustyö ennen traktorin aikaa. Arvio maatalouden työllisyydestä 1860-1948.” In: *Helsingin yliopiston talous-ja sosiaalihistorian laitoksen tiedonantoja* 20.

— (1988). “Agrarian World Market and Finnish Farm Economy: The Agrarian Transition in Finland in Late Nineteenth and Early Twentieth Centuries.” In: *Scandinavian Economic History Review* 36.1, pp. 26–45.

— (1992). *Talolliset ja torpparit: vuosisadan vaihteen maatalouskysymys Suomessa.* Suomen historiallinen seura.

— (2004). *Suomen maatalouden historia. osa 2, Kasvun ja kriisien aika 1870-luvulta 1950-luvulle.* Suomalaisen Kirjallisuuden Seura.

Peltonen, Matti (2019). "Kaupallistumisen kipupisteet: maatilatalouden murros 1800- ja 1900-lukujen vaihteessa." In: *Nälkämaasta Hyvinvointivaltioon: Suomi kehityksen kiinniottajana*. Gaudeamus.

Rasila, Viljo (1969). "The Finnish Civil War and Land Lease Problems." In: *Scandinavian Economic History Review* 17.1, pp. 115–135.

— (1970). *Torpparikysymyksen ratkaisuvaihe: Suomen torpparikysymys vuosina 1909-1918: yhteiskuntahistoriallinen tutkimus*. Kirjayhtymä.

— (2003). "Torpparijärjestelmä." In: *Suomen maatalouden historia: osa 1. Perinteisen maatalouden aika esihistoriasta 1870-luvulle*. Suomalaisen Kirjallisuuden Seura.

Ravallion, Martin (2016). "Interventions against Poverty in Poor Places." In: *Wider Annual Lecture 20*.

Rodrik, Dani, Subramanian, Arvind, and Trebbi, Francesco (2004). "Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development." In: *Journal of Economic Growth* 9.2, pp. 131–165.

Roikonen, Petri and Heikkinen, Sakari (2018). "A Kuznets Rise and a Piketty Fall: Income Inequality in Finland, 1865–1934." In: *European Review of Economic History*.

Sarvimäki, Matti (2011). *Agglomeration in the Periphery*.

Schön, Lennart (2015). *Maailman taloushistoria. Teollinen aika*. Vastapaino.

Soininen, Arvo (1974). *Vanha maataloutemme: Maatalous ja maatalousväestö Suomessa perinnäisen maatalouden loppukaudella 1720-luvulta 1870-luvulle*. Suomen historiallinen seura.

— (1985). "Uuden maatalouden kehityksen suuntaviivoja." In: *Uutta maataloushistoriaa. Helsingin yliopiston talous-ja sosiaalihistorian laitoksen tiedonantoja* 17, pp. 3–14.

Stock, James and Watson, Mark (2015). *Introduction to Econometrics*. Updated third edition, global edition. The Pearson series in economics. Essex: Pearson. ISBN: 978-1-292-07131-2.

Van Zanden, Jan Luiten (1991). "The First Green Revolution: The Growth of Production and Productivity in European Agriculture, 1870-1914." In: *Economic History Review*, pp. 215–239.

Vattula, Kaarina (1983). *Suomen taloushistoria 3. Historiallinen tilasto*. Tammi.

Vehkalahti, Kimmo and Everitt, Brian (2018). *Multivariate Analysis for the Behavioral Sciences*. CRC Press.

Vihola, Teppo (2003). "Maatalouden rakennemuutokset itsenäisessä Suomessa." In: *Suomen maatalouden historia: osa 2. Kasvun ja kriisien aika 1870-luvulta 1950-luvulle*, pp. 330–418.

Viita, Pentti (1965). *Maataloustuotanto Suomessa 1860–1960*. Studies on Finland's Economic Growth. Helsinki: Bank of Finland.

Wooldridge, Jeffrey (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT press.

Appendices

Table A1: Additional Specifications

	Levels		Cook's distance		Excluding 1940	
	Cows/X	Machines/L	Cows/X	Machines/L	Cows/X	Machines/L
	(1)	(2)	(3)	(4)	(5)	(6)
Bartik	0.77***	0.52***	0.57***	1.29***	0.23	0.85**
	(0.20)	(0.20)	(0.12)	(0.28)	(0.15)	(0.42)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,746	1,302	1,626	1,159	1,309	860
Adjusted R^2	0.69	0.78	0.92	0.92	0.94	0.88

Note: The unit of observation is a municipality. *Bartik* is a municipality-level measure of the intensity of the land reform. Controls include log farm size in 1910, log population density in 1910, the field under sand soil and the field under clay soil, each interacted with the post-reform dummy, as well as log temperature, log rainfall, municipal fixed effects and time fixed effects. All explanatory variables are expressed in logs, except for *Bartik*, clay soil and sand soil, which are expressed in proportions. Dependent variable is in levels in columns 1–2 and in logs in columns 3–6. All regressions are weighted by the number of farms in 1910. Robust standard errors in parentheses, clustered at the municipality level.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$